September 1992 Issue #14

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

features

vintage review

departments

Green Meadow Reaches Great Heights

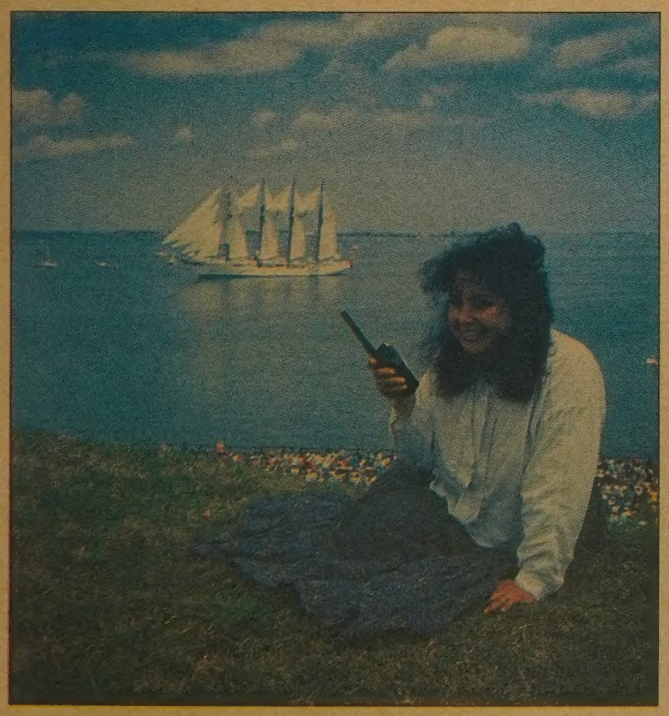
In less than one year the Green Meadow School of Maynard, Massachusetts, has made great strides in enhancing its curriculum in the areas of math, science and communication skills. This was made possible by establishing an amateur radio station in one of the fourth-grade classrooms. With funding from the Parents' Group, donations from the amateur radio community, and significant assistance from Marty O'Connell N1GIR, we made our first contact in October 1991.

Since then, hundreds of students have visited the station, many of whom have made contacts, and all have broadened their understanding of this field of communications. The most spectacular event by far was their involvement in SAREX. Four lucky fourth-graders were delighted with their seven-minute QSO with astronaut Brian Duffy N5WQW on board the space shuttle *Atlantis* in March.

Other noteworthy events included being granted club status by the ARRL and having one of the students receive his ticket. Ben Thorburn, age 8, was not only the first licensed Novice in the school, but the first in the entire school system and the youngest license holder in the town of Maynard.

As the school year came to a close, the group had an added thrill when members of the club journeyed to Rockland, Massachusetts, to meet their astronaut hero in person. *TNX Judith Johnson KA1WZM.*

Students from the Green Meadow Amateur Radio Club visited with astronaut Brian Duffy. Ben Thorburn (second row, farthest to the right), age 8, is the first student at the school to receive his Novice license.



Tall Ships

Amy Ashley monitors the amateur radio support activity as the Tall Ships sail into Boston Harbor. (See the story in the "Try Something New" column on page 20.)

Special Event Station Honors Civil War Soldiers

Members of the Warminster Amateur Radio Club (PA) operated a special event station (to honor Civil War soldiers) from the Union League Building in Philadelphia from 5 p.m. on Friday, March 27, through 6 p.m., March 28, making over 350 contacts with ham radio operators in the United States and Canada.

"The League was created in 1862 by members of both the Republican and Democratic parties to support the policies of President Abraham Lincoln when the Civil War was not going well for the Union side. Over 10,000 soldiers were enlisted by the League and more than one million dollars was raised for the war," according to organizer Doc Morein KA3RAU. "By contacting amateur radio stations worldwide, we honor all the soldiers who fought in the Civil War, both North and South," notes Morein, who is a member of both the Union League and the Warminster Amateur Radio Club.

The Warminster Amateur Radio Club has prepared a special 8-1/2" by 11" certificate commemorating the occasion for stations that contacted the special event station, operating under the club's callsign, WA3DFU.

The Warminster Amateur Radio Club, which is an ARRL Special Service Club, has over 200 members who are involved in all aspects of amateur radio. Members make a special effort to participate in community-oriented projects by providing communications support for events that recently included the March of Dimes WALK-AMERICA walkathons, the Special Olympics, the Clean Air Challenge Bike Trek sponsored by the American Lung Association, community road rallies, 10K and fun-runs, and weather exercise and disaster drills testing the emergency warning and notification systems for local agencies. *TNX William Gorodetzer K3MFI.*

Al Folsom KY3T gives QSL information with the encouragement of Doc Whitticar W3GAD and Frank WDØESL and Megan Clayton KA3YFP . The event was staged to honor all the soldiers who fought in the Civil War.

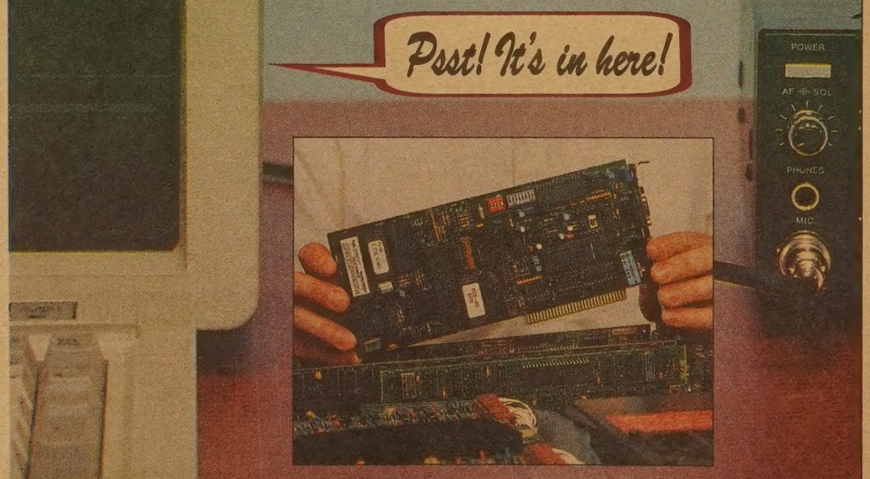
Now you see it....

The PK-88 is becoming one of the most widely used packet controllers in the world. In some areas, it is outselling its closest competitor by 10 to 1!

With the built-in 18k byte maildrop, you can use it as a "mini-BBS" in your area, and even automatically forward and reverse-forward traffic with your local PBBS. Or, just use it as a packet controller to help you catch that rare DX on your local DX packet cluster.

The PK-88 can be used with a dumb terminal or any computer with an RS-232 port and a communication software program (such as PC-Pakratt-88).

Now you don't.



The PCB-88 includes all the features of the PK-88 (above), and is easily installed in your IBM PC or compatible computer. Even if your shack is short on space, you can still have the best packet setup available.

In addition to the PK-88's features, the PCB-88 also includes TAPR's state machine DCD circuit and modem disconnect header for added performance and convenience.

To help make setup and operation a breeze, we've included AEA's powerful yet simple PC-Pakratt-88 software and an AC-1 12 VDC adapter (keeps the PCB-88 on when the computer is off – U.S. models only).

The PK-88 and PCB-88 packet controllers are the best money can buy, and that's no illusion!

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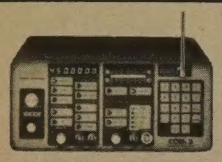


COM-3
$279.00

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.

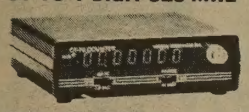
RSG-10
$249.00

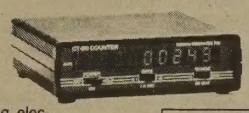
SYNTHESIZED SIGNAL GENERATOR

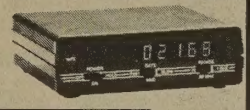
Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above • – 130 to + 10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz | **CT-90 9 DIGIT 600 MHz** | **CT-125 9 DIGIT 1.2 GHz**







Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

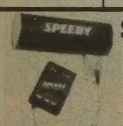
NEW CT-250 2.5 GHZ

ACCESSORIES FOR COUNTERS

Telescopic ship antenna—BNC plug, WA-10	$11.95
High impedance probe, light loading, HP-1	$16.95
Low-pass probe, audio use, LP-1	$16.95
Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 8.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$249.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95



SPEED RADAR $89.95 complete kit SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit $34.95
TR-1, RF sensed T-R relay kit $11.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88-108 MHz FM band up to 300' except for hi power FM-4 that goes up to 1/2 mile.
FM-1, basic unit $5.95
FM-2, as above but with added mike preamp $7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
MC-1, miniature sensitive mike cartridge for FM-1,2,4 ..... $2.95

MICROWAVE INTRUSION ALARM
A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $19.95

MUSIC MACHINE
Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 .. $12.95

PACKET RADIO
Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.

KIT	P-64A	$59.95
	P-IBM	$59.95
CASE	CPK	$12.95

LO NOISE PREAMPS
Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER
A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 $6.95

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER
Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

NEW

SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.
SP-1 ..... $29.95 Case-CSP $12.95

TICKLE STIK
A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit $9.95

LIGHT BEAM COMMUNICATORS
Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug." Transmitter + receiver set, LB56 .. $19.95

FM RADIO
Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit $19.95

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $6.95

BROADBAND PREAMP
Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit $14.95

•2 METERS •223 MHz •440 MHz

$149.95

FANTASTIC FM TRANSCEIVERS

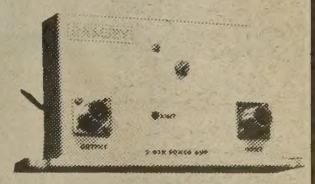
SYNTHESIZED—NO CRYSTALS

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? . . . . No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters)	$149.95
FX-223 kit (1¼ Meters)	$149.95
FX-440 kit (3/4 Meters)	$169.95
CFX matching case set	$ 24.95

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $89.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $89.95



QRP TRANSMITTERS HAM RECEIVERS

20, 30, 40, 80M CW TRANSMITTERS

20, 30, 40, 80M All Mode RECEIVERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP $12.95

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $29.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 Kit $24.95
Matching case & knob set, CAA $12.95

SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI $29.95
Shortwave converter kit, SCI $27.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

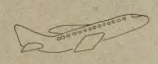
2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
Matching case set, CFM $12.95

AIRCRAFT RCVR



Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

TERMS: Satisfaction guaranteed. Examine for 10 days. If not pleased return in original form for refund. •Add $3.75 for shipping, handling and insurance. •For foreign orders add 20% for surface mail. •COD (U.S. only), add $5.00. • Orders under $20, add $3.00. •NY residents add 7% sales tax. •90-day parts warranty on kit parts. •1-year parts & labor warranty on wired units.

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CIRCLE 34 ON READER SERVICE CARD

Build the Easy Tap Key

The latest in "digital" technology

by Ken Gledhill AA7PE

During the annoying voids in our lives, many hams can be found tapping their index finger on a nearby surface to silently practice forming Morse characters. (Some of the more popular tapping surfaces include the arm of a chair, the back of a textbook and the edge of a steering wheel.) If you are one of these silent code tappers, you have probably noticed that it is much easier to just tap your finger to form the characters than it is to actually operate a mechanical key.

The electronic key shown in Photo A uses the same easy, natural finger tapping motion to key a transmitter, practice oscillator or whatever else you'd like. With no springs or screws to adjust, operator fatigue is a thing of the past. I call it the Tap Key.

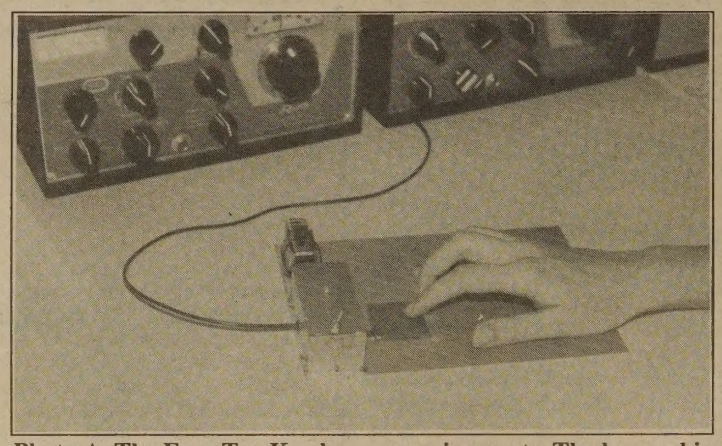

Photo A. The Easy Tap Key has no moving parts. The key pad is constructed with a small square of PC board glued onto a larger sheet (an etched PC board version is also available).

How the Tap Key Works

The basic principle by which the Tap Key operates is quite simple. The human body is neither a particularly good conductor nor is it a particularly good insulator. When a voltage is applied between two separate locations on the skin, only a very small current flows between these two points. Specifically, if the voltage is low, such as that which is available from an ordinary flashlight battery, the flow of current through the body is so small that it is completely imperceptible. (This is the same principle upon which many medical instruments and lie detectors work.) Nevertheless, as compared to the conductivity of the human skin, a CMOS digital integrated circuit has a very high input resistance. The Tap Key design uses the difference between the input resistance of a CMOS gate and the resistance of the operator's hand to switch a CMOS gate and to ultimately activate a reed relay. The transmitter or other keyed circuitry is actually actuated by the normally open reed relay contacts. There is no electrical connection between the Tap Key and the transmitter except through the common ground connection.

Since the input impedance of a CMOS gate is extremely high (usually in the 100s of megohms), the input to one of these gates is interpreted as a logical HI even though it is tied to the +9 volt supply through 30 megohms of series resistance. With an insulated plate connected to the same CMOS gate input, the logic level remains at a logic HI level as long as no finger tapping is going on. However, when the operator's finger touches the insulated tap plate while the palm or other fingers are on the base plate, the relatively low resistance of the hand "shorts" the two plates to ground and pulls the CMOS gate input to the logic LOW state. Since each of the two CMOS gates provides a logic inversion, the output of the second CMOS gate is back in phase with the signal at the switch plate. A single PNP transistor is switched ON when the second gate's output goes LOW, allowing approximately 20 milliamperes to flow through the reed relay in the collector circuit. It is the reed relay contact closure that actually keys the transmitter. Since the relay contact closure is essentially a mechanical switching process, there is really no difference between the Tap Key output and any other mechanical keying device.

Some Design Notes

The schematic diagram for the Tap Key is shown in Figure 1. There are four basic parts: the switch plate, a CMOS digital IC, a transistor and a reed relay. It is

Continued on page 6

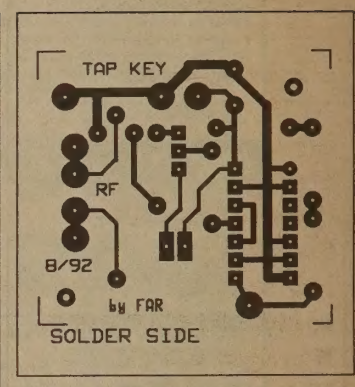

Figure 2. PC board foil pattern for the component board.

Figure 1. Schematic diagram of the Easy Tap Key.

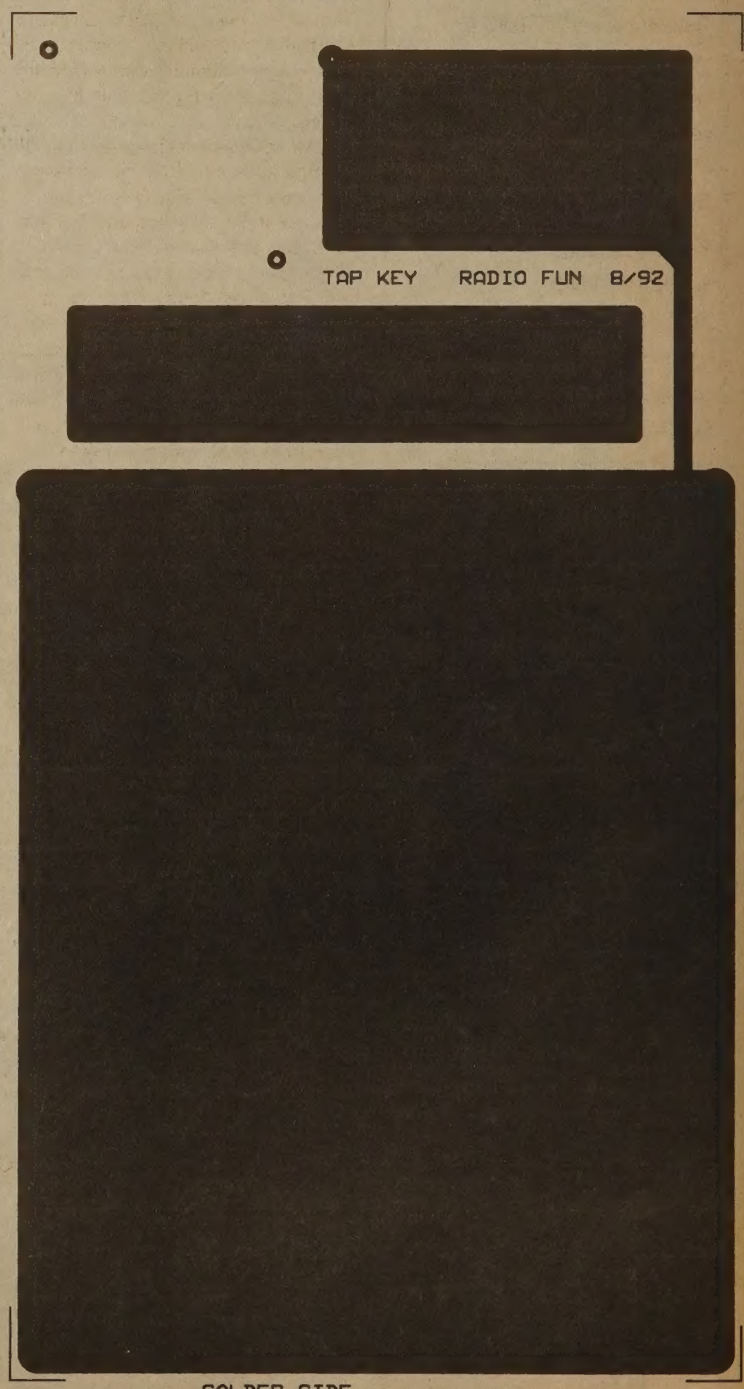

Figure 3. PC board foil pattern for the tap plate board.

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Wayne Green W2NSD/1
associate publisher
David Cassidy N1GPH

managing editor
Bill Brown WB8ELK
production editor
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editorial associates
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advertising sales representatives
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1-603-924-0058
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graphic design
Rachel Timper
desktop page make-up
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circulation manager
Harvey Chandler

Wayne Green, Inc.
editorial offices
Radio Fun
70 Route 202-North
Peterborough, NH 03458
(603) 924-0058
FAX: (603) 924-9327

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letters

Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

Art Stamler, Carrollton AL I have been a subscriber to *Radio Fun* for almost a year and have noted frequent references in letters and articles to old, outdated, surplus and other venerable items of equipment for which there seems to be little market value. What to do with portables, handhelds, base stations and other communications equipment which seems to have little future usefulness other than to occupy storage space has, I'm sure, troubled many an amateur radio operator.

On a recent trip to Guatemala I encountered an organization which is attempting to fill a need in some of the more remote areas of this poor country, by distributing radio units to firemen, emergency and rescue units who have either no ability to communicate adequately during a disaster, or whose equipment is unreliable. They asked if I might contact various amateur radio groups in the US for donations of any working items. Particularly needed are base-station and vehicle-mounted units, plus all sorts of "personal portables." Even CB (23- and 40-channel units) can be used. Short-range communication will be the usual rule, and whip antennas are preferred.

Anyone having such equipment and wishing to donate it to the Alabama-Guatemala Partners of the America should package it properly and ship it to me (P.O. Box 489, Carrollton AL 35447). I'll see that it gets to Guatemala, and will furnish the donor with a tax number for income tax purposes. Donors should be aware that all shipping and packaging costs are also usually deductible. Wherever possible, parts and repair manuals should also be sent, and all equipment should be in good working order or require only the most minimal repairs. 12 VDC and 110 VAC, plus vacuum tube and solid-state units can be utilized, plus appropriate spare parts for same. Who says there is no way to "make money" from otherwise unusable components?

Jeffrey L. Wheat AL7NY, Norton Air Force Base CA I enjoy *Radio Fun*. I am an Air Force MARS operator and there are lots of NTS messages on packet and all of these Techs could be pulling them off for delivery if they knew what they meant. I have not seen any no-code books cover NTS format, NTS packet or NTS in general. After any natural emergency the more people with half an idea of how to get the word in or out would help the ham image.

James S. Kaplan KG7FU, Bellingham WA I'm not sure exactly when the radio bug bit me, but it must have been early. When I was about 11, my uncle would give me motors and gearboxes to take apart for fun. One day he gave me a truckload of Army surplus electronics parts. Among the dysfunctional boxes was a shortwave receiver and a BC-458 aircraft transmitter.

I had to beg my mother not to throw out all that neat stuff, but all I could save was the receiver and the BC-458. After a little fiddling and some help from my father, I had the receiver working. I put up a 50- or 60-foot piece of bell wire and "tuned in the world." My whole family was disgusted with the mess I had made getting this antique piece of junk to work. Despite their misgivings, I was awarded a Radio Shack shortwave kit the following year as a birthday present (presumably to get rid of the old and dangerous stuff). That was in 1976, and I think Radio Shack has discontinued such fun kits. How many 12-year-olds do you know who could put together such a complicated kit now?

My love affair with radio waned for a few years and the shortwave receiver ended up in a closet (only to be sold years later at a ham flea market). Entering high school, I discovered CB radio.

CB quickly replaced SWLing and for a few years it had my complete attention. I met a lot of interesting folks through CB radio. Some are still good friends. Matter of fact, one of them was a fellow named Adam who claimed to be a ham by the call WA6LMO (I would later find out he was a bootlegger!) whose operating habits had a profound impact on mine. Partly through his influence and that of Joe DeAngelo KA6IWF (now KM6MK) I would later become a ham. (Adam "WA6LMO" wasn't your average bootlegger. He was a good operator and could copy CW in excess of 40 wpm in his head! He even helped several hams learn high speed code, including WE8K. Why he never got a "real" license is a mystery to all who knew him.)

I spent most of my high school days and a year or two after getting into a lot of trouble. I was having too much fun with girls and motorcycles and such to even stay in school. I ended up dropping out of school and working a myriad of strange jobs to support myself. I'm quite lucky my rebellious youth didn't land me a spot in jail or worse. I never did graduate from high school, but I later went back and took and passed the equivalency tests. I even went to the local community college and took some classes to better myself. Some of those classes were in basic electronics.

One day I was shopping for oddball electronic parts. The local electronic supply house didn't have what I wanted and I asked the salesman where to go. He told me of an electronic surplus outfit on the edge of town, so I searched it out. I found the place and was shocked to see what was inside. Advanced Component Electronics in Santa Clara, California, was just a warehouse of electronic surplus. I had never seen anything like it: palettes, racks and shelves bulging with resistors, ICs, capacitors and all sorts of finished goods rejected by manufacturers. I got what I came for and came back many times to fill my shelves with parts.

I came into the store one day with another purpose. I had clipped an ad for a sales position in the local newspaper. After a quick interview with the manager I was hired. This is where I met many local hams and KM6MK. Joe and I quickly became friends. He would always heckle me about being a CBer and bug me to get my amateur license. After awhile, I succumbed and he started teaching me CW. After two tries I passed the 5 wpm code test and the written one

Continued on page 7

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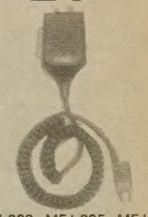

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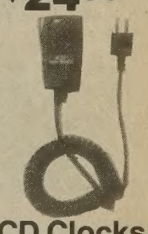

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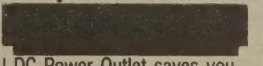

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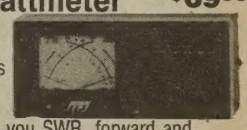

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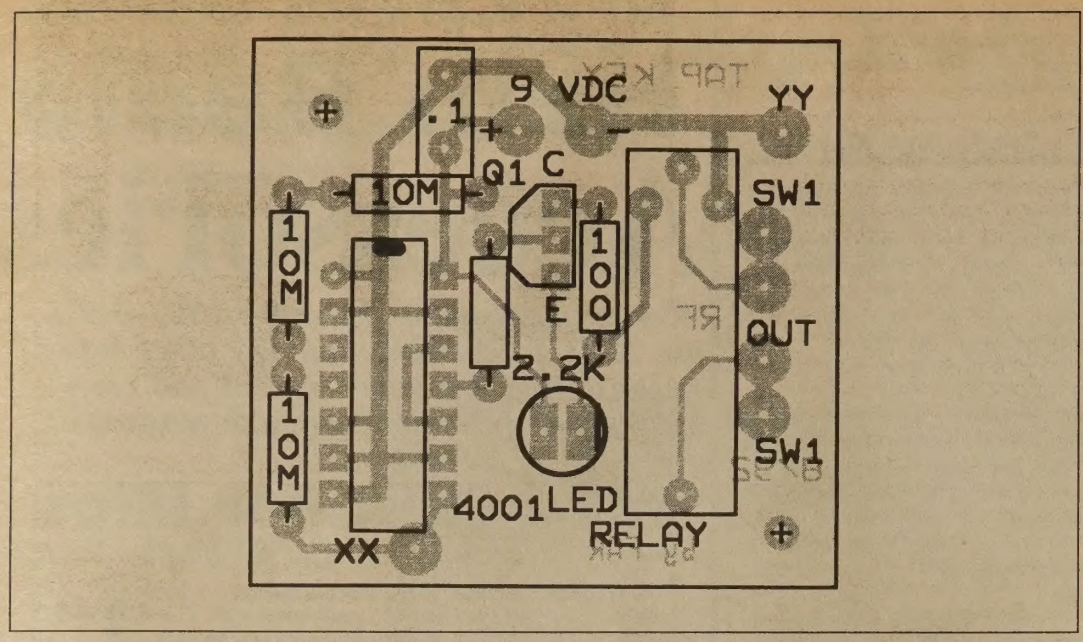

Figure 4. Parts placement for the component board.

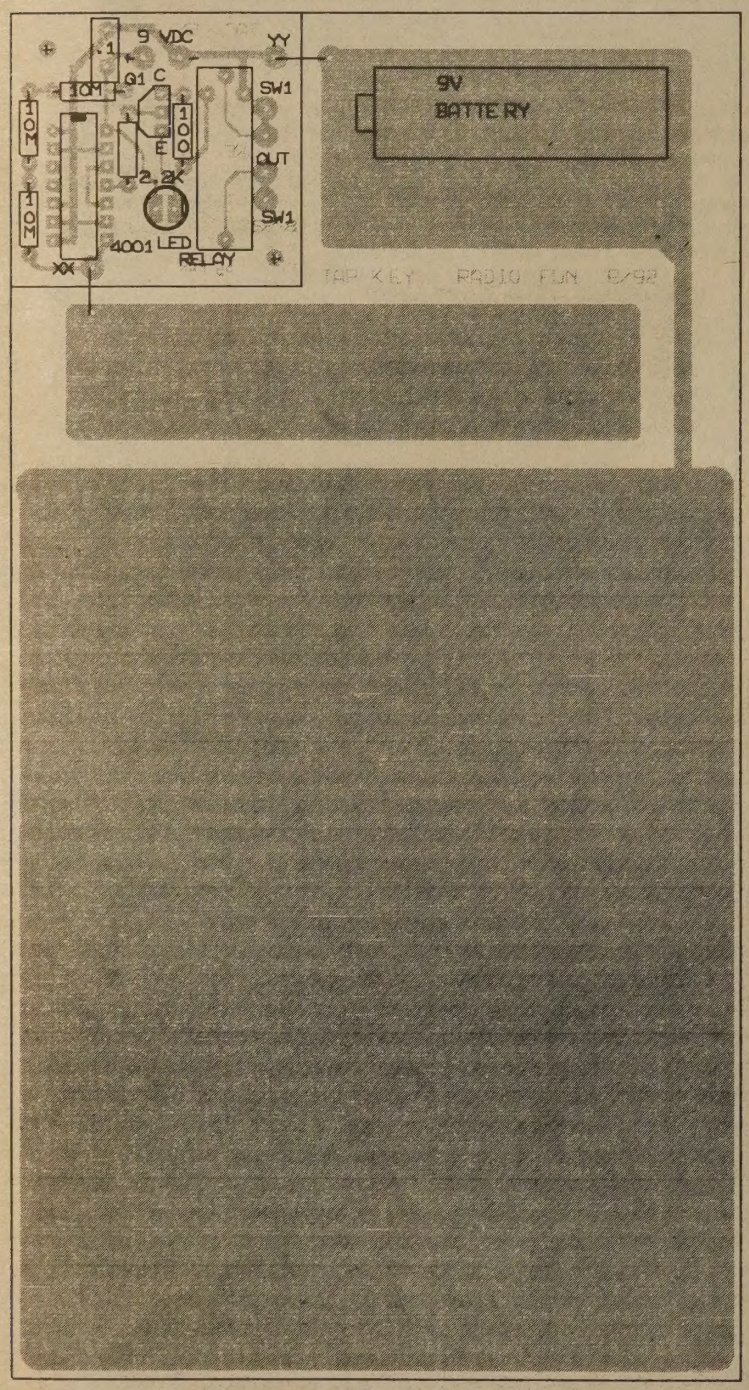

Figure 5. Attaching the Tap Key component board to the tap plate board. The small board is held in place by short jumper wires soldered between the two boards (note the two holes in the corners with no traces attached to them). Next attach wires from points "XX" and "YY" on the component board to the main tap plate board as shown. Then hook up a 9-volt battery to the indicated points and run a line to your transmitter's keying jack from the two pads marked "SW1 OUT".

Continued from page 4

really just a fortunate side issue that allowed me to include the LED without adding additional circuitry. I wanted to establish some additional threshold voltage margin on the back bias on the PNP transistor. By putting an LED in the emitter circuit of the transistor, I was able to develop approximately 2 volts of margin and provide the operator with a convenient visual feedback during operation. I chose a green LED since it has a little higher voltage drop than red ones. Actually, any LED that can handle 20 mA should work well.

The reed relay that I used is the little one that Radio Shack sells. It has a 250 ohm coil rated at 5 volts DC. If you are using a different reed relay from your goodie trove, you may need to adjust the value of the 100 ohm series resistor to assure that the coil has the proper operating voltage for reliable operation. If you are in doubt, split with the $2 and get the Radio Shack unit.

Almost any PNP transistor will work in this circuit; the common 2N3906 would be a good choice. For those of you who are knowledgeable about such things, you will also recognize that virtually any 4000 series CMOS gate will work with this circuit as long as it has at least two inverters. If you do use a substitute, be sure that all of the gate inputs are appropriately connected either to ground or to the +9-volt supply. (This includes both on the used and the unused gates.) Open inputs are a problem to CMOS integrated circuits.

Construction Notes

The components for the Tap Key are all readily available. It will cost approximately $15 if all the parts are bought new, but it could cost considerably less if your goodie box is of any help. The only part of the layout that needs any special attention is the placement of the tap plate. This smaller piece of copper-clad board should be glued in place on the base board so that it lies directly under the tip of the tapping index finger. The remainder of the layout is not critical. I built my prototype Tap Key using the "dead bug" construction technique (the back of the IC is glued on its back to the PC board with the legs sticking up). As an alternative to "dead bug" construction, an etched and drilled PC board set is available (see the Parts List).

Since I didn't want to have any screw heads on the bottom that could scratch the table top or allow the unit to slide around, all attachments to the base plate are either soldered or glued. A few stick-on feet would have fixed those issues too.

As you can see from the photograph, when the circuit was built, I enclosed the electronics by soldering together a box made from pieces of copper-clad circuit board. The enclosure provides both physical and electromagnetic protection. By comparing the Tap Key photographs to the circuit diagram you will notice that although there is a switch on the top of the Tap Key, it is not a power ON/OFF switch. In fact, there is no power switch at all. There is no reason for one. Like your LCD wristwatch, the Tap Key consumes so little power that battery replacement intervals are governed more by the battery's shelf life than by the key-down operating time.

The switch on the top of the Tap Key corresponds to the shorting bar on a standard straight key. Many transmitters require a continuous key down situation during tune up and/or during SSB operation. If you don't mind unplugging the Tap Key during these times, the switch is unnecessary. I find it a convenience.

PC board hints

For those of you using the PC board set, assemble the small component board and mount it above the large board via short jumper wires through the two holes on each board. Then just attach a wire between the small board and the large board at points "XX" and "YY" as shown in Figure 5. You can also use just the small PC board and construct your own tap plate out of a small copper-clad PC board glued to a large sheet of PC board as shown in Photo A. Then just attach point "XX" to the small square (the key tap plate) and point "YY" to the large bottom sheet.

Checkout and Operation

The Tap Key needs no calibration or adjustments. The LED on the top of the Tap Key flashes whenever the tap plate is being touched, regardless of whether the key is actually plugged into a transmitter or not. The circuit checkout consists of simultaneously touching both the base plate and the switch plate, using fingers of the same hand. If the LED illuminates, the circuit should be working. If the LED doesn't light up, go back and recheck your wiring.

Operation of the Tap Key is much like that of any other key. Just plug it into your transmitter's regular key jack and go. The Tap Key has quickly become my favorite. With no springs or levers, the Tap Key is truly effortless to operate. Without the fatigue, my characters are better formed, too. Several on-the-air contacts confirm the "normal" sound of the Tap Key. So, the next time that you are passing the time at a lengthy traffic light by drumming out Morse code characters on the steering wheel, remember the Tap Key and maybe you'll just get the urge to build one for yourself. RF

Parts List

3 ea.	10 megohm resistors
1 ea.	100 ohm resistor
1 ea.	2.2k ohm resistor
1 ea.	4001 CMOS integrated circuit
1 ea.	PNP transistor (2N3906 or equal)
1 ea.	5 volt reed relay, 250 ohm coil (see text)
1 ea.	LED, any color
1 ea.	0.01 MFD capacitor
1 ea.	SPST toggle switch (optional)
1 ea.	9 volt battery
1	copper clad PC board

The two etched and drilled PC boards shown in this article are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The small component PC board is $3 when ordered separately; a set of both boards (the component board and the large tap plate board) is $8. Please add $1.50 per order for shipping/handling.

letters

Continued from page 5

for my Technician license. That was in April 1988. I was awarded the call N6SJE. Later that fall, I married and moved to Tacoma, Washington, and traded N6SJE for N7LXQ.

I spent a good deal of time working odd jobs in the Tacoma area, as the electronics industry there was immature compared to the San Francisco Bay Area, and jobs were few. I once again answered an ad in a newspaper. This one was different. This ad asked that the applicant be knowledgeable in electronics, sales and optionally be a ham radio operator! I interviewed with another ham, John Schnieder KB7AK, in Seattle. Again, after a brief interview, I was hired.

John's company is RF Specialties of Washington. I was schooled in the fine art of selling radio broadcast equipment. I spent the next two years having the time of my life. I learned nearly all there is to know about the radio broadcast business from some of the best engineers (and hams) in the industry. I traveled the country to attend trade shows and visit radio and TV stations.

Unfortunately, this dream would soon turn into a nightmare. My wife decided to divorce me and move with our son back to California. I decided to stick it out on my own in Seattle for a while, but soon decided to go back to California to be near my family. I did, but not before upgrading to KG7FU.

I spent a little while with one of the companies I formerly sold equipment for in Santa Clara, California. I again started to travel the country and even represented them at a broadcasters' trade show in Brighton, England. After that I joined another former salesman in a venture to sell equipment outside of the "old boy" network in California.

A few months back, I got a call from John Price N7MWV, asking me if I'd like a part-time job wiring a few studios at KEZX in Seattle, John told me about a radio station in Bellingham that was looking for an engineer. I made the call and met with the general manager on a Saturday afternoon (I even called back to California to have a copy of my resume faxed). I had a nice interview, and toured the beautiful city of Bellingham before returning to Seattle to finish the job.

I went home to California and a few weeks later the station manager called me and we worked out a deal. I am now the chief engineer at KPUG AM and KAFE FM.

I can't stress enough how amateur radio has affected my life. I have always had positive experiences on the air and with every eyeball QSO. It has given my otherwise topsy-turvy life a positive direction. I have made countless friends through it, and without it I doubt I'd be where I am today.

Walter R. Fleet N3KVK, Coudersport PA You people sure are persistent. I received the Premier edition, then every one after that except the April issue. I guess you were giving me a broad hint.

You have already saved me the price of a subscription with the article on converting a standard electric clock to a UTC model. That in itself is worth it. So here is my check for a one-year subscription. Thanks again for keeping after me.

Ted Lesley, Culpeper VA I am a Ham Wannabe in information collection mode and I'm overwhelming myself with data. I go into a radio supply store, stand around the publication section and pick up a bunch of magazines, then pretend to look at them while I eavesdrop on a salesman and usually learn something by osmosis. I'm also a computer guy who thinks that packet is really nifty. I run a Macintosh BBS now, and see running a packet BBS as a logical step once I become appropriately licensed.

I find *Radio Fun* to be incredibly intimidating when I don't think it has to be. I have been fortunate enough to have an elmer from work helping me, but I keep thinking of many of my friends who could enjoy and benefit from the hobby, but can only pick it up off the streets.

But your publications are a breath of fresh air. There is much in every issue for the neophyte. I am building my knowledge and my confidence as I read *73 Amateur Radio* and *Radio Fun*.

And I want more! I want a section in your magazines for the ham orphan, for someone who, for some reason, is not ready for salesmen, clubs, "strangers," or whatever. How about something for the beginner's beginner? Also, a glossary of terms discussed in the issue or article, in plain English, would help a lot! Every time I see yagi, I look for Boo Boo. RF

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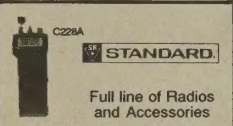

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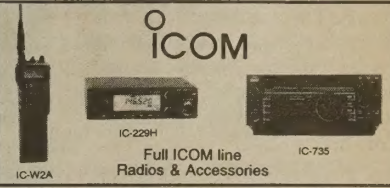

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Summer School for Radio Active Hams

by Larry R. Luchi W7KZE

I was introduced to amateur radio as a child, and have continued my studies in electronics with a ham ticket for over 30 years. While in the sixth grade, Del Avery W7BGH conducted my first amateur radio exam; 12 weeks later I was on the air. Several years ago I was compelled to make a career change and I chose teaching as my second career. Now, as the electronics technology teacher at Sno-Isle Skills Center, my time is spent teaching my hobby.

Sno-Isle Skills Center is a vocational high school that serves 25 high schools with a student population of approximately 850 11th- and 12th-graders. The school's name is derived from two counties, Snohomish and Island, and is located in Everett, Washington. The pristine Olympic Mountains are visible to the west and the majestic North Cascades to the east, just 25 miles north of Seattle.

Students are bused to the Skills Center for two three-hour blocks of instructions each day: a morning class and an afternoon class. The students receive six elective credits a year for their training. In the third quarter of this two-year program, I teach amateur radio (communications electronics), and all of my students have their Novice/Technician or higher-level license. This year Doung Nguyen AA7JN, a senior from Everett High School, upgraded to Extra; Devin Corbett KI7CA, a senior from Arlington High School, and Joshua Luellen N7UBR, a junior from Everett High School, upgraded to Advanced; and Matt Castain N7YCC, a junior from south Widby Island, upgraded to General. During summer school these students were acting as my teacher's aides.

At the completion of their first year we award each student a handsome certificate of completion that the American Radio Relay League supplies. They also received three Continuing Education Units that can be used for college credit.

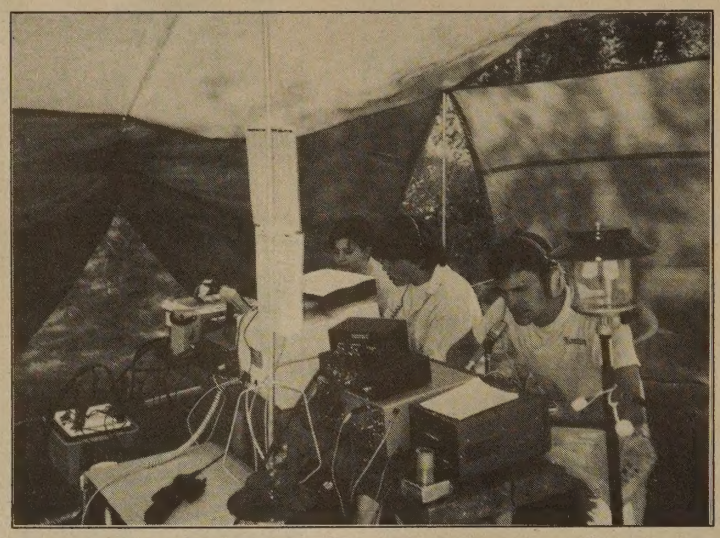

Photo A. Caleb Benefiel and Matt Chastain operate the portable ham station during Field Day.

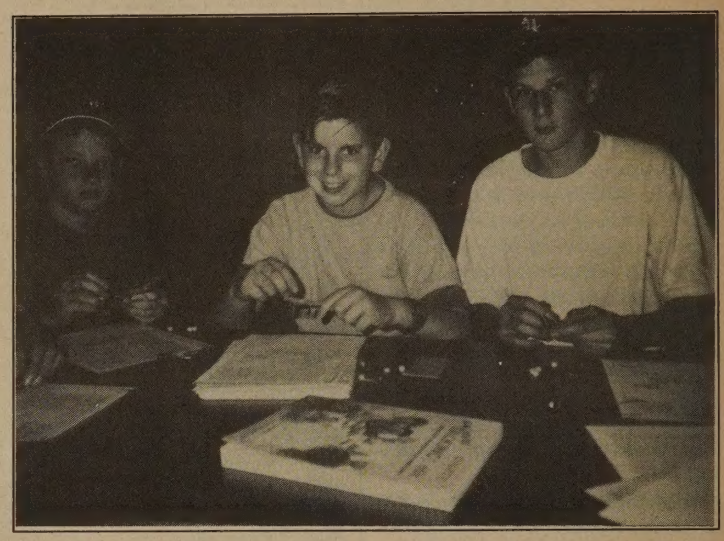

Photo D. Joey Chackeye, Caleb Benefiel and Rocky Ottow finish putting their first kits together.

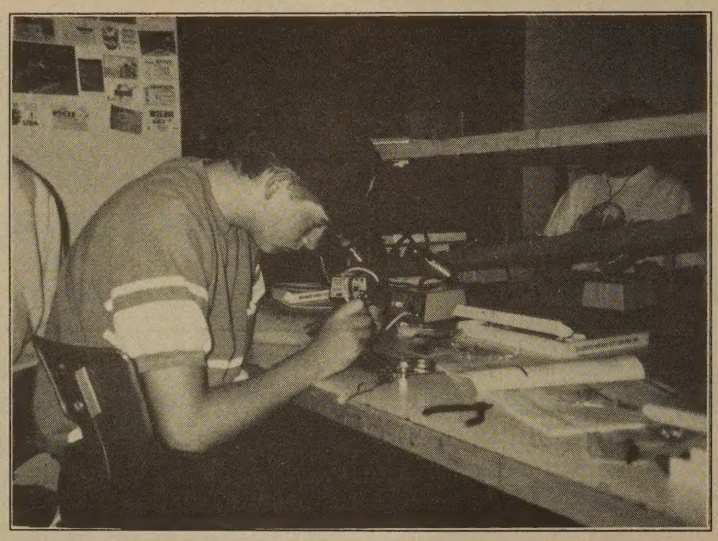

Photo B. Brian Johnson solders his AM/FM radio project.

Photo E. Caleb Benefiel assembles his AM/FM radio kit.

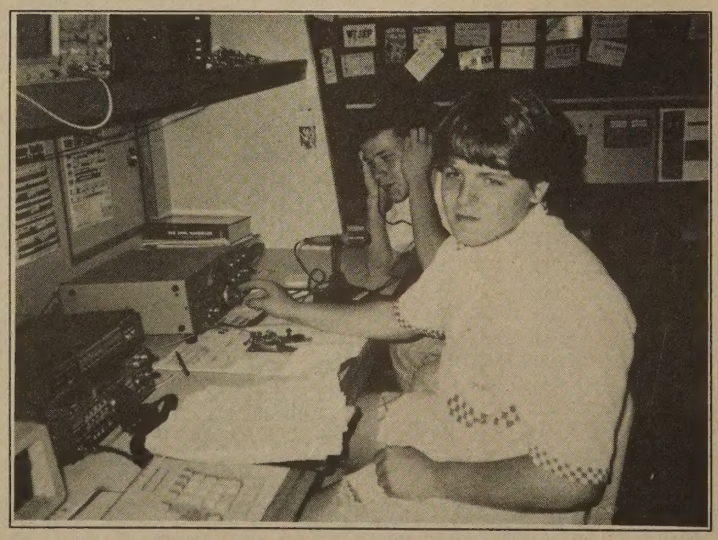

Photo C. Matt Chastain and Oliver Christian use the ham station at the Sno-Isle Skills Center.

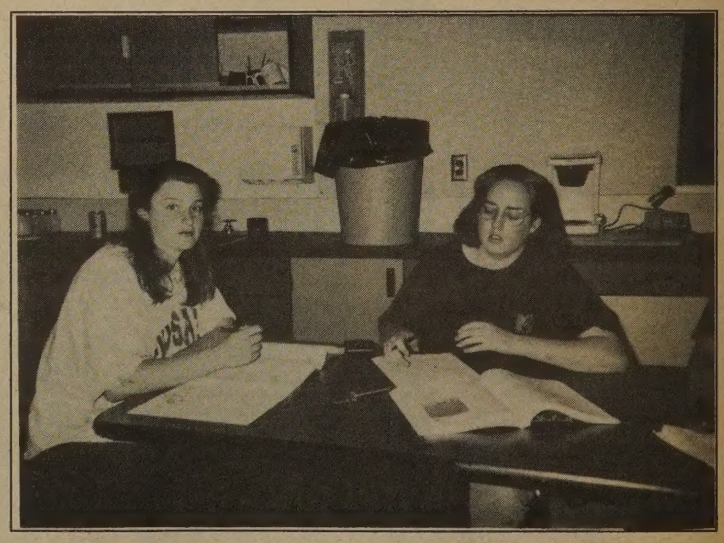

Photo F. Amanda Rosario and Marie Hundley discuss questions about ham radio.

Summer School

Every school year I teach a summer school course on ham radio that we use not only to help kids gain their amateur radio license, but also to introduce them to electronics in a hands-on-training environment.

Summer school in Washington State is fun. The Superintendent of Public Instruction allocates funds each year for a 90-hour, one-credit course of instruction for ninth- through 12th-graders. The only cost to the student is bus fare to school and lunch.

For the past six summers I have taught a ham radio class from 8:30 a.m. to 2:30 p.m., with great success. My seventh year proved to be the best, with more interest and the most students. This year summer school started June 22 at 8:30 a.m. with 22 students and a record-breaking heat wave for the Puget Sound, 92 degrees. After introductions, I explained the course of instruction and showed the students the ARRL's video, "The New World of Amateur Radio." This video is 26 minutes long. Then I issued each student a copy of *Now You're Talking!*, an ARRL study guide for the Novice/Technician license. Finally, I showed them an 11-minute video of our "QSO with the Shuttle *Columbia*."

Soldering was the first skill for each student to master, and then we moved on to the international Morse code. In our ham shack we have an Advanced Electronic Applications' PK-

232-MBX multimode data controller that I use as part of the Morse code training. With our Kenwood TS-830S in the CW sidetone mode without plate power, and the PK-232 in Morse code receive mode, every student sends CW and watches the letters and prosigns that appear on the EGA monitor. To the students, this was almost the same as a video game. Amanda Rosario, a senior from Mariner High School, and Marie Hundley, a junior from Marysville-Pillchuck High School, mastered this approach to learning Morse code quickly. They both passed the five wpm exam at our monthly ARRL Volunteer Examiners session.

To add to the summer school fun, I gave the students two kits to build and take home at the end of school. One was the code-practice oscillator kit found on pages 11-16 of *Now You're Talking*. John Fluke Mfg. Co. donates 200 kits each year to my program, complete with a printed circuit board and a 9-volt battery. The second project was an AM-FM kit that the students built. This provided a break between CW practice, rules, regulations and electronics theory lectures, and gave the students more hands-on training.

To provide hands-on training, I formed the kids into work teams. One team replaced N-connectors on our Cushcraft AOP Oscar antenna array, while the other team relocated our AEA IsoPole 2 meter antenna and replaced the PL-259 coaxial connectors. The last team had the most difficult task, that of installing our AEA 430-16 amateur television beam atop our 70-foot tower where our Cushcraft A-3 four-band beam is mounted. Matt Chastain N7YKC and Caleb Benefiel KB7OWO made several trips to the top of our 70-foot tower with the mast and ATV beam. Every one of the students rotated jobs to provide as broad an exposure as possible to becoming good ham radio operators.

Back to the classroom, where the students studied from a 15-question open book quiz each day from *Now You're Talking*. During the 30 minutes of CW practice, every student sent and received at least five words per minute. Our ham shack is a nine-foot by 12-foot room at the back of the classroom. Amanda called me into the ham shack to show me that she could send her name and mine (she is right-handed) using her left hand, with our names displayed on the monitor. Soon all the kids wanted to try left-handed sending. Three weeks into the summer school, Matt N7YCK upgraded to Advanced and passed his written element for Extra. Caleb KB7OWO passed elements 1B and 3B for his General class license.

Our first field trip was Field Day 1992. On June 27th we set up a station with the BEARONS ARC (Boeing Employees Radio Operators North). The BEARONS had three other stations plus ours. We operated as a 4A designator from the Boeing Activities Center's picnic area, located in south Everett. Our club president, Howard Selmer N7RTT, was in QSO with a California station early Sunday morning when the earthquake hit Southern California; this gave my students another "real-world" example of emergency operations.

The final day of summer school arrived, and ARRL Certificates of Completion were passed out as our ARRL Volunteer Examiners prepared the tests. Six students passed the Tech-Plus, CW (five wpm) and Elements 2 and 3A for their Technician-Plus license. Sixteen students passed Elements 2 and 3A for their no-code Technician license. Summer school 1992 was a very rewarding experience for both the instructor and the students.

Industry and Community Help

Our "Radio Active Summer School" was a very successful program due to the involvement of members of the electronics industry and the elmers from the community. Del Taft W7EVI was first licensed on January 21, 1935, and Bill Ostrowski K7TII in May of 1954. We used Bill's callsign, K7TII, during Field Day operations. These elmers, and other Boeing amateurs and John Fluke Mfg. elmers gave the kids the help and encouragement they needed to become good amateur radio operators. We hope to work you next summer with our new bunch of "Radio Active Kids." RF

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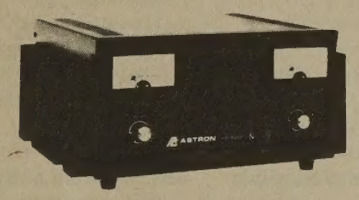
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RS-5L	4	5	3½ x 6⅛ x 7¼	7

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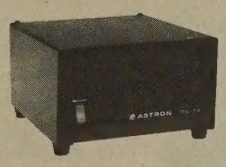
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES


MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES


MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

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VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES


MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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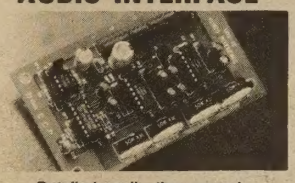
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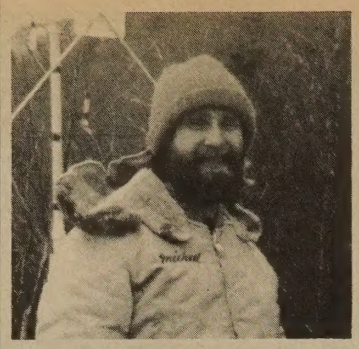

the tech side

by Michael Jay Geier KB1UM

Still More Power Supplies

Last month, we covered the general repair of linear power supplies with shorts. That's the most common scenario, but there are others. Sometimes components open instead of shorting. Also, the supply may have a switching regulator or it even may be a switching power supply. For now, let's stick with fully linear supplies, and then take a look at the other types later on.

Open Wide

When a part opens, current stops flowing. That much seems obvious. But depending upon which part goes, the effect can vary from no output to too much output! Let's take a look at some of the problems you might encounter.

If the open circuit is in the main current path, the supply will go dead. The best way to find the problem is to turn it on and *carefully* check voltages, starting at the output of the power transformer and working through the rectifiers, filters and regulator until the voltage disappears. By the way, I'm assuming here that the power supply is of the low-voltage variety; high-voltage supplies, such as plate supplies for tube circuits, require special voltage probes and must be approached with extreme caution. Luckily, all of today's rigs are solid-state and use low-voltage supplies. Most run on 12 volts, with a few having built-in power supplies which supply 28 or even 48 volts to the RF power amplifiers. Of course, dangerous high-voltage power supplies are still found in external linear amplifiers, because they use tubes.

When you've found the point where the voltage exists on one side of a part but not on the other, you've found the trouble. It's as simple as that. Well, almost. If the problem appears to be the regulator transistor, you must check to see that its base (or gate, in the case of an FET) has voltage on it. If the base is at zero volts, the transistor will be cut off and no current will flow through it even though it is good. If the base is indeed dead, check the parts feeding it. Typically, there will be a couple of resistors, or a potentiometer, sampling the output voltage and feeding it back to the base. Along the way, the signal may pass through another transistor or two, or even an IC op amp. Any one of those may be open.

Also, look for a zener diode, which uses the same schematic symbol as a regular diode except that it has slanted lines connected to the flat one. Zeners are connected backwards, because their junctions break down and start conducting in the reverse direction when the voltage across them reaches a preset level. The exact breakdown voltage is built into the zener and can be determined by looking up the part's number in a spec book. If you're lucky, the voltage may be shown on the supply's schematic. If the zener shorts, it will take the voltage across it to zero, possibly making the supply look open. If the part opens, the voltage across it will rise to whatever it would have been had the zener not been there.

Ya Gotta Look Around

If you do find a bad regulator transistor, take a good look at any resistors connected to it. If current strong enough to blow a transistor passed through them, they may be cracked or otherwise damaged. If you see cracks or obvious heat damage, replace the resistors. Sometimes they can even go bad with no visible damage, so it pays to check them with your ohmmeter (with the power off, please!) before assuming that they are OK. For that matter, take a look around any time you find a bad component; it is very common for one part to take a few others when it goes, especially in circuits where high currents are being passed or controlled.

I'd Rather Switch Than Squeeze

If a linear regulator can be thought of as squeezing the passageway of the current, then a switching regulator is more like a light switch. In fact, that's almost exactly what it is. The basic idea is this: After being stepped down by the power transformer, rectified and filtered, the power is chopped into a continuous series of pulses. Then, it's refiltered into DC. What's the point? Well, the trick is that the width of the pulses can be controlled by a circuit called a pulse-width modulator. The wider each pulse, the more power is transferred. The narrower, the less. By using a sample of the final output voltage to control the pulse width, regulation can be accomplished. If the output is too high, the pulses are made narrower. If it's too low, they're made wider. What's the point?

The point is that, by using the transistor as an on/off switch instead of a variable resistor, no power has to be wasted as heat. Well, almost none, anyway. In real life, it takes some time for the switch to turn on and off, so it does act like a resistor for very short periods. Compared to a linear regulator, though, the switching regulator is extremely efficient.

The problem is that rapid pulses with fast rise and fall times are hard to control. They cause all kinds of harmonic noise across the RF spectrum. They also can cause semiconductor failure in marginal designs and sometimes even in good ones. It ain't easy to turn large amounts of current on and off thousands of times per second.

Troubleshooting a switching regulator is not much more difficult than fixing the linear version, but it is best done with an oscilloscope. The trick is to see if there are pulses at the base of the series pass (regulating) transistor. If the pulses are there but there's no output, the transistor is bad. If there are no pulses, check the IC that should be generating them; most likely it is bad. (Needless to say, the chip requires DC power to run, so check that it is there before replacing the chip.) Even if the IC isn't getting a sample of the output voltage on which to base its pulse width, it should always be generating pulses. They may be very narrow or very wide, but they should be there.

El Switcheroo

A true switching power supply is somewhat like a switching regulator, but it has some major differences. Here's how it works:

The incoming AC power is rectified and filtered directly to DC without being passed through a step-down transformer. So, naturally, it is at a fairly high voltage, typically from 150 to 350 volts or so. Now, this high DC voltage is chopped by a series-pass transistor just like the one in a switching regulator. The chopped power is passed through a small step-down transformer, emerging from the other side as low-voltage, high-current pulses. Before we go on, let's take a look at the purpose of doing it this way.

Big And Strong

A transformer works by converting electrical energy into a magnetic field and back again. The actual conversion back to electricity occurs when the magnetic field *changes*, which is why you can't pass DC through a transformer—it doesn't change. (That's also why you can't get electricity from a stationary magnet.) At the standard 60-Hz AC line frequency, a fairly large amount of power must be transferred in each cycle, because the filter capacitors are only being replenished with power 60 times every second. Thus, the transformer must be rather large in order to have enough iron in its core to store all that magnetic energy. You see, iron is like any other storage medium—it can only hold so much before it becomes saturated and can hold no more. The result is that you wind up with a big, heavy power supply.

Smaller Is Better

By chopping the power into short pulses, we reduce the amount of power the transformer must handle during each cycle. So, we can use a much smaller transformer! Of course, we could just chop the power up, send it through the transformer and then regulate it afterwards, but why bother? Since we're already making pulses, why not simply regulate their width and send only the amount of power we actually need through the transformer? What could be more efficient than that?

And that's exactly what a switching power supply does: It samples its final DC output and regulates the chopping circuit to keep the output voltage constant. Simple, right?

Messy and Dangerous

Well, in theory. Early switching power supplies were very simple. Unfortunately, they tended to self-destruct! Like I said before, switching large amounts of power very fast causes all kinds of problems unless the circuit designer is very care-

ful. Even then, it can be tricky. I remember one little color TV set made around 1970. It was one of the very first consumer products to have a switching power supply. Some of those sets worked great, while others kept dying. No matter what parts you changed in the power supply, it would die again in a month or two. The only fix was a complete new power supply. Nobody, not even the manufacturer, ever did figure out what the problem was. I was lucky; mine worked fine and still does, over 20 years later!

Thanks to the personal computer revolution, switching power supplies have evolved into dependable workhorses. There are millions of them pumping away on desktops all over the world. The designs have gotten much more complicated. Now, you'll find various inductors (coils) and protection circuits. They are effective at protecting the supply from those mysterious failures of old. The one thing they don't protect, though, is you.

The Dangerous Part

In a linear supply, the step-down transformer comes before the rest of the circuit (except perhaps for the on/off switch and the fuse). In addition to reducing the voltage, that transformer isolates the power from the AC line and the house ground (because there's no electrical connection from one side to the other). Because the step-down transformer comes so much later in a switching supply, much of the circuitry is connected *directly* to the AC line. This unisolated circuitry is *dead*. Touching it is exactly the same as sticking your finger in a wall socket. Don't do it! Unless you own an isolation transformer and really know what you're doing, you are looking for serious trouble. That's why most computer power supplies are considered swap-outs only; nobody wants to repair them. If you must work on a switcher, disconnect it from the AC line, discharge the filter capacitors and make "dry" (unpowered) ohmmeter measurements only. Protect yourself!

Crowbars

No, not social hangouts for birds. Crowbars are protection circuits which are designed to blow the supply's fuse if the output voltage rises too high. The idea, of course, is to protect your radio from overvoltage damage. Crowbars are simple: The output voltage is monitored and a circuit trips a part into causing a direct short across the supply if the voltage goes too high. Normally, the voltage never gets that high, so you don't know the crowbar is there. Only if the supply malfunctions will the crowbar trip. If you find a blown fuse, check to see if there's an SCR (silicon controlled rectifier) across the supply, either at the output or directly across the AC line after the fuse. The schematic for an SCR looks kind of like a diode but with a third leg. That third leg is the gate which is used to turn the SCR on and blow the fuse. Sometimes, a failed crowbar can blow the fuse even though there is nothing wrong with the supply! It pays to check it.

As you can see, power supplies can be more complicated than they might seem. With practice, you can learn to fix them. But, above all, remember: Don't risk your safety for any reason. Even at low voltage, high current can cause you serious injury. I remember reading about one case in which someone shorted across a high-current supply with a ring on his finger. The ring became red-hot almost instantly, and the hapless individual lost his finger! Don't let something like that happen to you. Happy and safe troubleshooting! 73 till next time from KB1UM. RF

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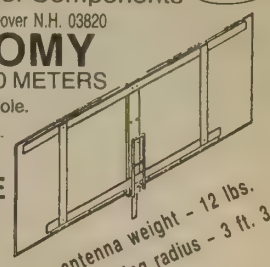
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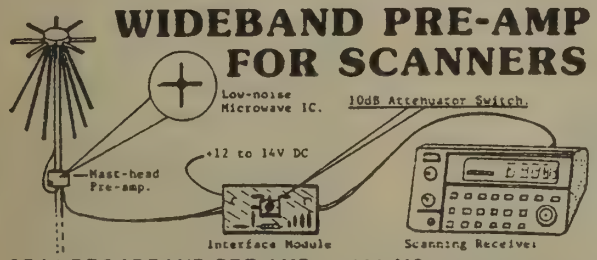

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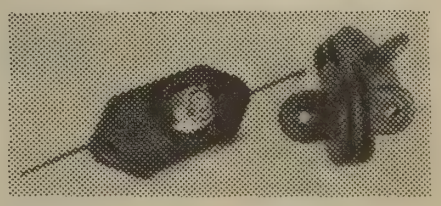

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computers in the shack

by Jeffrey Sloman N1EWO

Explore the Possibilities

If you've been reading this column for the last couple of months you have a basic idea of what packet radio is and how to put a packet station on the air. While packet is clearly the most popular digital mode available to hams, it is certainly not the only one. Part 97—the FCC rules and regulations that govern the Amateur Radio Service—provides for several other forms of digital communications.

What Can You Do?

I am guessing that a large number of you reading this column hold Technician tickets, so let's take a look at what is available to Technician operators. First of all, a Technician license holder can run *any* sort of digital communications—allowed by the rules—above 50 MHz. This includes RTTY (Radio TeleTYpe) and its variations, ASCII (American Standard Code for Information Interchange) and its variations, and even a code of your own invention—as long as certain particular conditions are satisfied, which we will discuss later.

In the HF bands (below 30 MHz) those of you who passed the 5 wpm code test also have some space on 10 meters. The rules aren't quite as liberal in the HF band. On 10, data transmissions are limited to 1200 bauds—that is, 1200 on-and-off transitions each second—and no unspecified codes may be used. Still, from 28.1 to 28.3 MHz, any digital mode that falls into this category is OK. When 10 meters is open, DX is possible to all over the world.

What Are These Other Modes?

Good question! Let's take them as groups and look at what each does well. The first, and oldest, of the digital modes is RTTY. RTTY has been around for a long time. You will sometimes hear RTTY referred to as "Baudot," after J.M.E. Baudot (baw-doe), a French engineer from the 1800s who worked with telegraphy. "Bauds" (or baud) are also named for him. Baudot is not really a kind of signal; it is one of the codes used to transmit information via RTTY. Baudot code contains five "bits" or information atoms. These can be thought of as ones or zeros. By combining all the possible arrangements of these five ones and zeros, it is possible to have a code with 32 characters. This is pretty limited so Baudot code only provides uppercase letters, numbers, and a few symbols. In this way it is similar to the Morse code.

There is another type of RTTY, called 6-bit RTTY, that adds a bit to the code which doubles the number of symbols it can produce. (HINT: Raising 2 to the nth power, where n = the number of bits in the code, will get you the number of characters that the code can handle.) With 64 possibilities, 6-bit RTTY can do upper and lowercase alphabets.

As you can see, Baudot is not very flexible as far as alphabets go. It works OK if what you want to send is simple text, but it doesn't have the space for special characters or binary data transmissions (like programs or graphics). ASCII—the American Standard Code for Information Interchange—was designed for just the purpose that its name suggests. There was a need for an extended digital code for computers and communications, and ASCII, with its roomy 8-bit characters, lets users transmit and store 256 different characters. This set includes special

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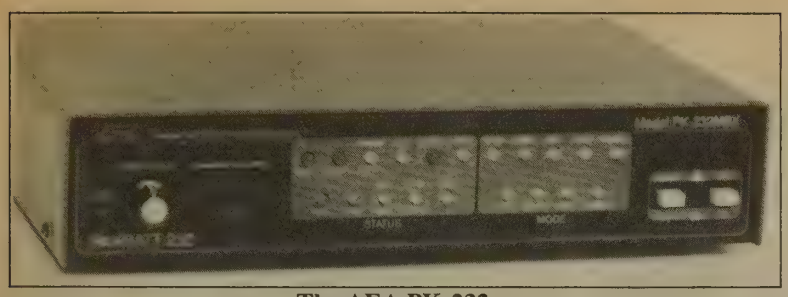

The AEA PK-232.

"control" characters that instruct the receiver to do various things. For example, the ASCII character represented by 00000111 (the number 7) tells the receiving station to ring a bell (today it's a beep), and two characters —SO for Shift Out, and SI for Shift In—can be used to tell the receiver that characters that fall in between these codes should be treated specially. This can be used to send additional characters used by foreign alphabets, for example.

AMTOR is an extension of RTTY. It uses the 5-bit Baudot code, so it is limited to its small character set. Even still, on the HF bands where it is intended to be used, AMTOR has a big advantage—error detection and correction. If you remember our discussion of packet from a couple of months ago, packet radio does something similar. The process is called ARQ, for Automatic ReQuest to send. The idea is that information—in the form of a checksum (a mathematical operation performed on the data before it is sent)—is sent along with the data and must be right when it gets there. If it is not, the receiving station says "send it again," and the process repeats until it is correct.

You might ask, "If it is like packet, why not use packet?" Good question. Packet radio is a technology adopted from networks that were connected by wires, not radio. While VHF/UHF radio can come close to those conditions—little fading, relatively little QRN (natural noise)—HF is a disaster in those terms. Packet sends a whole bunch of data in each packet (actually correctly called a frame). This makes interference or fading very likely to disturb a frame on its trip from here to there.

AMTOR, which stands for AMateur Teleprinting Over Radio, on the other hand, uses very, very small frames—two characters, in fact! This slows it down quite a bit due to the overhead of exchanging ACKs (ACKnowledgements) for each one, but it also punches the data right through—even in really lousy band conditions. This tiny packet size gives AMTOR a unique and recognizable sound. When you are tuning around the HF bands, you will hear it—a brrp, brrp, brrp, brrp—about two bursts per second. AMTOR is used by a system called APnet to forward packet traffic, very reliably, all over the world.

In addition to ARQ operation, used when in QSO with another station, AMTOR also provides FEC (Forward Error Correction) capability for bulletins and calling CQ. FEC mode sends the error correction data along with the signal, allowing the receiving station to correct bit errors without requesting a retransmission. It is not foolproof, but works surprisingly well. The ARRL uses FEC mode to transmit official bulletins on HF, and it is used by coastal radio stations to transmit telex and weather information to ships at sea.

Recently, DF4KV and DL6MMA of Germany have made an effort to combine the advantages of packet and the FEC of AMTOR into a mode called PACTOR. It is another step forward in HF data communications. It uses advances in computer technology that were just not there when AMTOR was designed. Let's hope that the new mode, or something like it, catches on—positive progress is always good.

Roll Your Own

If you are a digital experimenter, your Technician class license gives you the opportunity to help advance the state of the art in digital communications over radio. Pick any ham band above 30 MHz and go to work. There are only a few restrictions:

Legal Operation: Of course you must be in a ham band and your transmitter and signal must meet FCC standards.

Bandwidth: From 6 meters up to 2, the maximum permissible bandwidth is 20 kHz. From 1.25 meters to 70 centimeters, stay within 100 kHz. Above 902 MHz, the band's the limit—anything that will fit is OK. NOTE: This *is* limited by the band plan for the band in question, of course!

US Only: Though there is a provision for special agreements with other countries in the unspecified codes section of Part 97, none are currently in force. This means your communications must be with stations in the US.

No Codes or Ciphers: Huh? I thought this *was* a code! Well it is. The point of this limitation is that the purpose of your unspecified code must not be to obscure data. Because of this, the EIC (Engineer In Charge) of your FCC field office may require that you:

Stop Transmitting Your Code: Restrict the transmission to whatever extent deemed necessary. Keep a complete record, convertible to the original information, of all information transmitted in your code.

If you intend to experiment—and by all means do!—you should first read and understand all the pertinent sections of Part 97. You do have a copy, don't you?

The PK-232

Well here's where your exploration begins. All of these modes, with the exception of the unspecified codes (of course), are available in the form of commercial equipment. All the major manufacturers sell "multimode controllers." These boxes can do just about everything when it comes to digital mode communications. To get an idea of what they are like, let's take a brief look at the PK-232MBX from AEA in Lynnwood, Washington.

The PK-232 is an attractive black box about 2.5" x 8.5" x 11". On the front panel are an array of indicator LEDs, a tuning display—used for tuning RTTY, AMTOR, and packet signals in SSB mode on HF—and three controls: "Threshold" for the DCD (Data Carrier Detect) function, "Radio 1/2" to select between radio ports, and the power switch.

The PK-232 works on both VHF and HF providing these modes: packet, RTTY (Baudot and ASCII), AMTOR, Morse code, HF WEFAX (Weather FAX), NAVTEX (marine telex broadcasts), TDM (Time Division Multiplex), and SIAM (Signal Identification and Acquisition Mode). This box does just about everything! The last one, SIAM, is AEA's feature that lets the controller tell you what you are listening to. This is great for beginners and SWLs. The PK-232 manual is about 75 or 80 pages in a three-ring binder. It has lots of information—though a beginner might feel a little overwhelmed. There are informative tutorials to help get you started in each of the modes, and full schematics and parts lists.

The PK-232 runs VHF packet like all the other TNCs out there. There isn't a whole lot of variation among TNCs. On HF, though, the PK-232 really shines. Its clean design and excellent engineering let it copy signals that are barely audible with surprising accuracy. Tuning is relatively easy, thanks to the built-in bar graph tuning indicator. With a little practice, it becomes almost second nature to get the tuning right.

PC-PAKRATT, AEA's IBM-PC terminal program for the PK-232, is a good way for beginners to get started with the unit. AEA hasn't forgotten you Macintosh users, either; for you there's MacRATT. The program understands all the modes of the PK-232 and handles the commands for you. Keep in mind, though, that there are also third party programs with even more features. Talk to friends or ask on the repeater about what people use with theirs. I found that after I became comfortable with the unit, I switched to using it from a terminal emulator (just a regular communications program, like ProComm) and used the command line to control the PK-232. The commands are not hard to remember, but then, I guess I am just a command line sort of guy.

The PK-232 is an excellent way to get started in the world of digital communications that lies beyond VHF packet. But, as usual, I suggest you get on the local repeater and start asking questions. Find yourself a "digital elmer" and, when you become an expert, help someone else out! People are ham radio's greatest resource.

Keep Those Cards and Letters Coming

Thanks for all the letters you've sent. Next month I will answer some of them in the column. I really love to get feedback from you—it can get pretty lonely at the keyboard. Let me know what you want to see and hear in the column—it is intended to be a resource for you. I also need to know what I am doing right or wrong. Constructive criticism is greatly appreciated. Until next month, 73 de N1EWO. RF

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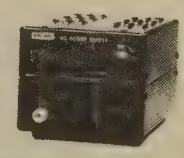

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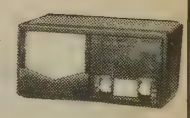
CN-103	140-525Mhz	20/200W	SO-239 or N
DP-810	1.8-525Mhz	0-1.5kW/0-15W	SO-239 or N
DP820	140-524Mhz	0-150W	SO-239 or N
DP-830	1.8-150Mhz	0-1.5kW	SO-239

other meters available



CN-101

CS-201

CS-401

SWITCHES	CS-201	CS-201GII	CS-401	CS-401G
Frequency	500Mhz	1.3gHz	800Mhz	800Mhz
Connectors	SO-239	N type	SO-239	N type
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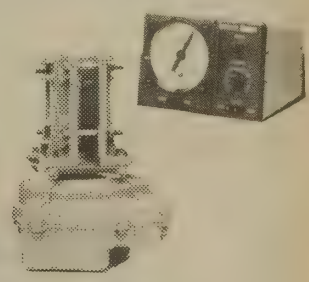

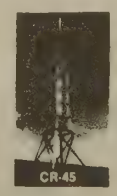

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model	height	base width	max. width load ft.2	max. vert. load lbs.	weight
CR18	5'10"	31 1/2"	21@90mph	440	18
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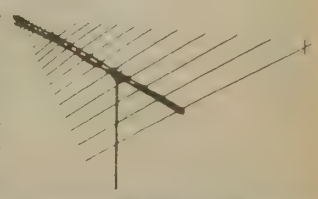

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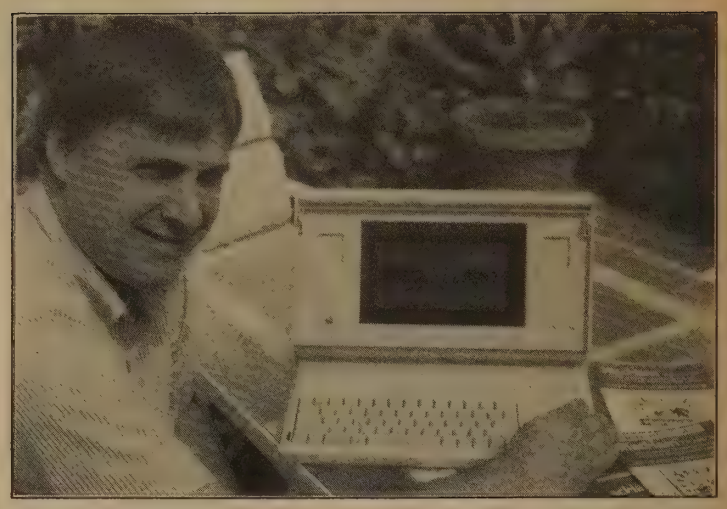


Photo A. "MacHam" inventor Richard Coyne KD6CPE demonstrates his new software for Apple computers.

Computer Test Prep

Amateur radio testing and training software is available for both IBM and PC-compatible computers, as well as Apple Macintosh computers. Both the theory and the code may be studied on the tube.

There are many different types of study methods using computer software. Not all the programs are the same. This month, let's take a look at some of the differences.

By order of the Federal Communications Commission, your real theory examinations must come exactly word-for-word from the test question pool. The question pools for Novice through Extra class are in public domain, and what you study on your computer will be exactly what will be on your test. Same questions, same right and wrong answers, but not necessarily in the same A-B-C-D order. That's important to know.

What's Available

If you have already studied your test preparation training manuals, computer-generated sample examinations are just for you. The "W5YI Ham Operator Education Package" contains seven diskettes which cover all written theory and Morse code examinations. You can review all the questions, print out sample tests, or take exams administered right at the computer keyboard! This course is almost identical to what has been released to volunteer examiners to actually generate written and CW exams.

The W5YI (P.O. Box 565101, Dallas TX 75356; 817/461-6443) computer course does not contain explanations after each question and four multiple-choice answers. It's intended more for code self-checking and theory progress, as opposed to enlightening you about why a specific answer is indeed the correct one.

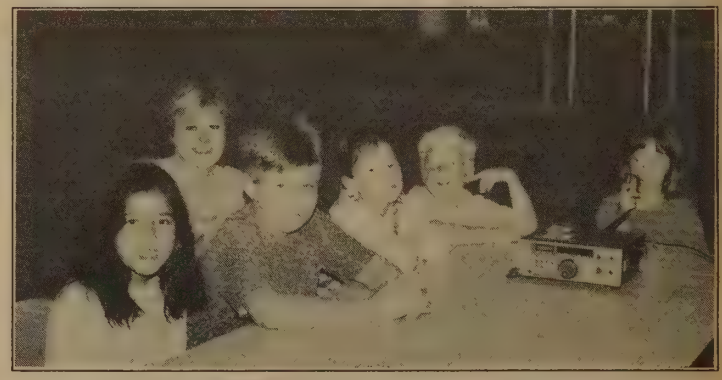
If you would like some help sorting out right from wrong on your IBM PC computer, MFJ Enterprises (P.O. Box 494, Mississippi State MI 39762; 800/647-1800) offers a theory training program that generates sample VEC-type exams from the complete question pool, including graphics, *as well as* explanations. It's those explanations that may be important for you to review if you are preparing for the written portion of your examination exclusively on the computer.

For those of you with an Apple Macintosh computer, at last there is a code and theory program specifically for amateur radio licensing. Developed by Richard Coyne KD6CPE, MacHam™ software is a terrific way to go. Their Technician course includes both Novice Element 2 and Technician Element 3A test questions, answers, on-screen graphics, and all the appropriate sounds to let you instantly know whether or not you answered that particular question correctly. Each exam can be taken on the screen, or printed out. They also have a higher grade program that contains examination material for the written General, written Advanced, and written Extra class tests. The on-screen test results can be quickly printed out.

By the way, a recent survey shows that Apple desktop microcomputers increased market share by 7 percent over last year, giving both Apple and IBM major market shares. So whether

what next?

by Carole Perry WB2MGP



Jennifer Shane W5WFP rehearsing for the STS-50 SAREX pass with children from College Park Elementary School, LaPorte, Texas. Left to right: Rachael Benavides, Cody Amundson, Jeannette Bustillos, Austin Hall, Jennifer N5WFP. Back, second from left: Mary Cummings, science teacher.

The 20 to 1 Net

I always enjoy getting letters from ham radio operators from different parts of the country who are doing exciting things in the hobby. It's especially nice to learn about activities involving youngsters. I was, therefore, delighted to hear from Gary Shane WB5WOW concerning his participation with SAREX, and his daughter Jennifer's participation as well.

As net control of the CQ All Schools net during the school term, I have great respect for any other net control who is in a position of great responsibility. Jennifer Shane W5WFP, age 11, has organized a net for young people originating from Houston, Texas. The Youth Net (originally called "20 to 1") meets at 7 p.m. Central time on Thursdays on the Johnson Space Center W5RRR repeater (146.64 MHz).

Jennifer tells me that the check-ins, which include parents as well as children, exchange information about ham radio events going on in the Houston area. The young people like to talk about themselves, their interests, and what schools they attend. Jennifer says that there are usually five to seven people on the air swapping information. Occasionally there are even 7-year-olds who check in with their parents. Jennifer's main objective is to interest young people in ham radio just like her dad did for her. The net is designed to encourage people from ages 20 to 1 to learn about radio procedures, license requirements, upgrading information, and even to talk about homework.

Her dad tells me that even before Jennifer got her license she was participating in community activities promoting the spirit of amateur radio. In December 1990 she participated with her parents and other members of the Clear Lake Amateur Radio Club at the Humana Clear Lake Hospital where children who were confined to the hospital were able to talk to Santa Claus via ham radio. Jennifer was one of Santa's elves who brought holiday cheer to the sick children over the air. Those hams who were at the children's bedsides were amazed at the children's reactions when Jennifer came on the radio.

In January 1992 Jennifer was awarded the Clear Lake Amateur Radio Club's "Good Guy Award" for her participation in community service events supported by the club, including a bicycle race, weekly nets, etc.

In February 1992 Jennifer held the first session of the "20 to 1" net through which she hopes to get newly licensed young people in the area involved and active. She wants to generate interest in ham radio by having ham parents check in with their children to peak their interest. Jennifer acts as net control, and has designed the fliers which are distributed at the local VE test sessions, local schools, etc. This was the first "Youth Net" in the Houston area and it has received great support from the local amateur community.

In February 1992 Jennifer participated in an Amateur Radio Information Seminar at the Harris County Public Library in Seabrook, Texas, with KA5GLX and KB5AWM of the CLARC club in Clear Lake. The audience was sixth-grade children and Jennifer was a big hit with the students who were in attendance.

In May, Jennifer was selected to act as control operator for the next SAREX mission, STS-50, in June, for a school pass on behalf of a school in LaPorte, Texas. She participated with the STS-50 crew during a mission simulation at the Johnson Space Center. She has been working with the seven other children selected by the school to get them prepared for speaking on the radio and using correct radio procedures. As of this writing, the flight is scheduled for the end of June.

Jennifer has plans to upgrade to General class this summer after school is out, and then to start DXing. This precocious 11-year-old is a straight-A student, and is also participating in the Gifted and Talented Program offered through the local school system. She will be in the sixth grade next year. She also plans to continue her active participation in club-sponsored community service events, her Youth Net, and in recruiting new people into the amateur ranks.

CLARC is stressing not only the science aspect of the Space Shuttle and using radio to communicate with the astronauts, but also to familiarize the students with amateur radio. The club has flooded the school with ham radio posters and brochures. Elementary school is a great place to plant the seed of amateur radio. The Clear Lake amateurs continued to work with elementary students to prepare for SAREX on STS-50.

On June 3rd, the students of College Park Elementary School in Deer Park came back to school from summer vacation for a SAREX practice session. The goal was to make sure that the students could speak clearly and slowly when asking the astronauts their questions, pass the microphone quickly between students, and fit all the questions and answers into a four-to-five-minute window. Jennifer, of course, helped out with the training sessions.

Three different simulated Shuttle passes were run. The students had created excellent questions, such as "Is it hard to work in space when you are sick?" and "What is the primary goal of this flight?" When the practice session was over, a kindergarten student said, "I sure wish we were doing this for real today!"

Some of the CLARC hams who assisted with the SAREX effort besides Jennifer and her dad, Gary, are Ruth Barrett AB5EI, Dick Wilke N5SPU, and Bob Biekert KA5GLX. The Johnson Space Center Amateur Radio Club is assisting, with help from John Nickel WD5EEV and Gil Carmon WA5NOM.

For more information about Jennifer's 20 to 1 Net, call the Houston Area Amateur Radio Hot Line at (713) 488-4HAM. RF

Photo B. "MacHam"—new software with great graphics.

you have an Apple or an IBM, amateur radio operator computer software is available to you.

The W5YI theory and code course includes both a 3-1/2" as well as a 5-1/4" set of diskettes for either home or laptop computers. If you own both types of IBM or Tandy computer systems, you have diskettes for both pieces of equipment!

When it comes to code practice, the W5YI group is the popular choice by students. If you already know the code, the code program that comes no charge with the theory program is ideal for you. It will generate CW examinations at 5 wpm, 13 wpm, and 20 wpm, just like the real thing. The W5YI material has been developed by Steve Sternitzke NS5I. And if you don't know the code, the W5YI group offers a diskette program for all IBM and Tandy computer owners. It will teach you the code, letter by letter. Steve makes it fun to learn the code on your desktop or laptop computer.

So do the disks from the American Radio Relay League, developed by GGTE Systems. Not only can you learn the code, letter by letter, but you can also practice typical CW examinations at any speed, and there's even an advanced version for instructors and elmers to develop their own amateur radio code examinations. MFJ also has some great amateur radio code software, too.

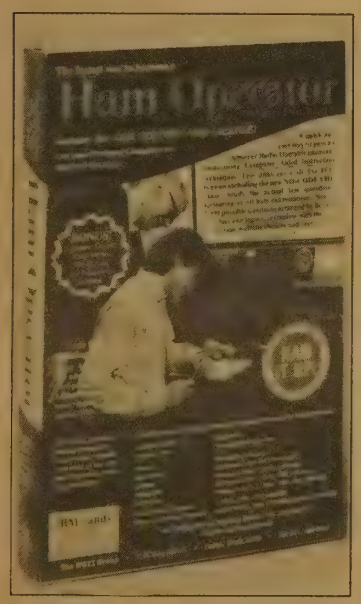


Photo C. W5YI software for test preparation on IBM and Tandy computers.

How Long Are They Good?

So if you're planning on upgrading, check out all of the things you can do on your home or personal computer. All of the courses are good—don't even think of asking which one is "best". If you want the "best" success in upgrading, get one of each of these programs, try them out, and then sell them or pass them on to a friend who may also be going up the amateur radio testing ladder.

When will your study material be out of date? Novice and Technician class questions will change instantly next year on July 1st. This gives you plenty of time to upgrade using existing material.

General class Element 3B theory examinations change July 1, 1994. Plenty of time.

Advanced class Element 4A written examinations change on July 1, 1995.

Extra class Element 4B written examinations change on July 1, 1996.

As long as you purchase your computer training materials before next January, you have plenty of time to upgrade to Novice or Technician class, and years of time to use the material for General, Advanced, and Extra.

The computer is one fun way of testing your skills! RF

Thirteen Days in Space

SAREX flies again on STS-50.

by Philip Chien KC4YER

At 12:12 p.m. EDT on June 25, 1992, the space shuttle *Columbia* roared off of the launch pad and disappeared into a thick cloud deck. On launch day the weather seemed to be the big concern, with thunderstorms and heavy cloud layers, but it cleared up enough to permit an almost-on-time launch. Among the seven-member crew were two ham astronauts: commander Dick Richards KB5SIW and mission specialist Ellen Baker KB5SIX. This was the beginning of another SAREX (Shuttle Amateur Radio EXperiment) mission on its way into space for a record-breaking flight.

This was the first 13-day shuttle mission. Not since the 1974 Skylab 4 mission had U.S. astronauts spent so long in space. *Columbia*'s Extended Duration Orbiter (EDO) modifications made it capable of staying in space longer than the other shuttles. These modifications included additional oxygen and hydrogen tanks to produce power and water, additional breathing air, a new system to remove carbon dioxide from the crew's atmosphere, and additional storage space. The mission was almost three times the length of the STS-37 SAREX-D mission.

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Continued on page 18

Photo A. The *Columbia* launch (STS-50). Photo courtesy of NASA.

Photo B. Dick Richards KB5SIW and Ellen Baker KB5SIX display their callsigns.

Photo C. Dick Richards KB5SIW receives an SSTV uplink from Addison Elementary School in Marietta Georgia.

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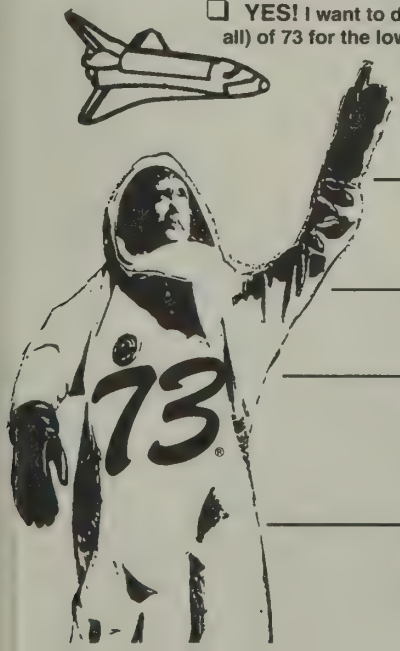

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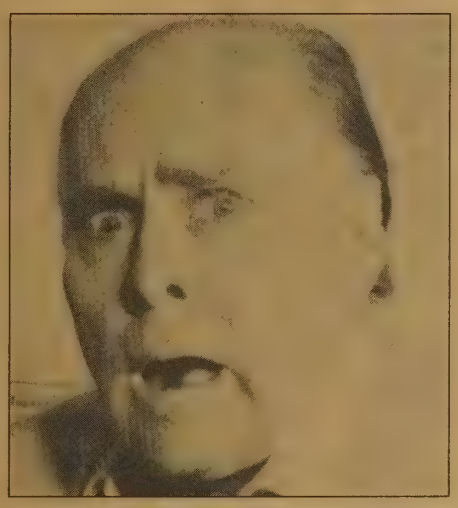

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tion, direct educational contacts were completed with schools in Australia and Africa.

The SAREX-D Configuration

The crew used the SAREX-D configuration, including voice, packet, two-way slow-scan, and fast-scan receive modes. To save space, the combination VCR/monitor used on the STS-37 mission was removed. The shuttle's on-board monitors were used to view SSTV and FSTV video transmissions from the ground and video was recorded on a camcorder. A more important modification to the antenna was required. The side-window SAREX antenna used on the STS-35, -37, and -45 missions would not have worked well due to the shuttle's attitude. The USML mission flew a gravity gradient attitude, with the shuttle's tail pointed towards the Earth, nose away from the Earth, and the payload bay pointed 12 degrees away from the flight direction. The attitude optimized the microgravity environment for the Crystal Growth Furnace experiments.

Antenna Difficulties

The dual-band antenna (2 meter voice/packet/SSTV, 70cm ATV) was repackaged into a rectangular antenna which was designed to squeeze into an overhead window, similar to the antenna used on the Spacelab 1 and Spacelab 2 missions.

Johnson Space Center ham Jerry Coles KB5ARA was able to perform a fit-check of the antenna in *Columbia*'s overhead window, but didn't have enough time to perform a full set of SWR checks. After returning to his office, he made several modifications to improve the antenna's performance, but the schedule didn't permit a checkout of the changes with an actual shuttle orbiter.

Repackaging the antenna caused several problems. Apparently the antenna didn't fit into the window snugly, and ground stations had difficulty hearing the crew well. In addition, the orbiter's gravity gradient attitude didn't permit long contacts.

The SAREX team at the Johnson Space Center tried several adjustments before determining that the antenna didn't have a good ground with the shuttle's structure. They sent up a set of InFlight Maintenance (IFM) instructions, which Ellen Baker completed. Basically, this involved wrapping portions of the antenna with aluminum tape to get a better ground between the antenna and the orbiter's body.

With antenna performance problems, the decision was made to put all SAREX operations on the same frequency and optimize the antenna for that frequency. While it worked well for most contacts, there was a lot of interference during preplanned school contacts by hams trying to complete random QSOs with the shuttle.

Leno Uplink via ATV

Fast-scan television was transmitted to the shuttle by the same stations as the STS-37 mission. Jim Steffen KC6A in Long Beach, California, made arrangements with Jay Leno to pre-record a monologue just for the astronauts. This was successfully seen by *Columbia*'s crew. The Goddard amateur radio club WA3NAN made arrangements for Willard Scott to tape a landing day weather forecast. Other ATV uplink stations included Andy Bachler N9AB of Motorola ARC, Schaumberg, Illinois, Kai Siwiak KE4PT in Ft. Lauderdale, Florida, the Marshall amateur radio club WA4NZD, in Huntsville, Alabama, and the W5RRR station at the Johnson Space Center in Houston, Texas. Dick Richards reported that he "had a tremendous [ATV] signal from the US Naval Academy; they were uplinking fast-scan to us." Unfortunately, he couldn't record their video because the camcorder was in use at the time.

Photo E. *Columbia*'s landing (main gear touchdown and parachute deployed).

Close Encounter With *Mir*

The shuttle crew requested that they attempt a contact with the Russian space station *Mir* and the W5RRR team contacted the *Mir* control center. The *Mir* crew was informed in time and tried calling the shuttle on a regular basis as both spacecraft passed over South America. Ground stations in Brazil heard both sides calling out and the Russians aboard *Mir* reported hearing the shuttle calling them. Unfortunately, *Columbia* could not hear *Mir* due to interference from ground stations. Dick Richards reported, "We wish we could say that we had some luck, but we didn't." At their closest approach the two spacecraft came within 115 km. (62 nm.) of each other.

Canoe Contact

While *Columbia* didn't have a successful contact with *Mir*, they did contact a sailing canoe, the Hokule'a (Ho-Koo-Lay-Uh). The Hokule'a is a 62-foot twin-hull sailing canoe, a replica of an ancient Polynesian voyaging canoe, which many of the crew referred to as the "spaceship of our ancestors." Like the ancient Polynesians the Hokule'a's crew are accomplishing their ocean voyages without any instruments or charts, but unlike their ancestors, their canoe has an HF ham rig for long distance communications.

Hokule'a in Hawaiian means "Star of Gladness." The Western name for the star is Arcturus and, appropriately, it's one of the navigation stars which shuttle crews use to determine their position and realign their inertial measurement units. When *Columbia*'s crew contacted it, the canoe was traveling from Hawaii to Tahiti, with an ultimate destination of Rarotonga in the Cook Islands to attend the Pacific Arts Festival. The canoe had already completed three major ocean voyages before its current journey. The Hokule'a contact was performed via the Hawaii relay station, using a phone patch from the HF rig aboard the canoe to the Hawaii relay station, and from there via 2 meters to the shuttle.

An Extra Day

Columbia's landing was planned for Wednesday, July 8th, at Edwards Air Force Base in California. Rain caused by Hurricane Darby prevented *Columbia*'s return, so flight controllers decided to keep *Columbia* in space for an additional day. Capcom Ken Reightler radioed up the "bad" news—that the crew would have a stronger lock on their shuttle endurance record.

There wasn't enough time to restart any of the experiments so the astronauts got a day off to take photos, relax and enjoy their view of the Earth. Landing weather on Thursday wasn't any better at Edwards, so flight controllers decided to return the shuttle to the Kennedy Space Center instead. It was *Columbia*'s first Kennedy Space Center landing, and the first KSC landing with the drag parachute.

In many ways STS-50 was somewhat frustrating due to the antenna problems and interference with everybody sharing the same frequency. But it did include several school contacts, slow-scan TV uplinks and downlinks, ATV uplinks and a unique ship-to-ship contact with a sailing canoe.

In terms of science, the investigators were ecstatic with the results of their experiments. Every piece of Spacelab hardware worked perfectly, and many additional experiments were completed which weren't in the original timeline—in fact many of the crew indicated that they weren't tired at all, and were perfectly willing to stay in space for an additional couple of weeks!

Photo D. The crew of STS-50 poses for an in-flight photo. Front row (L to R): Carl Meade, Ellen Baker KB5SIX and Eugene Trinh. Middle row (L to R): Lawrence DeLucas, Richard Richards KB5SIW and Bonnie Dunbar. In the back (standing on the wall): Kenneth Bowersox.

Post-Mission Comments

We talked with Dick and Ellen and their fellow crew members after the mission about their ham activities:

Dick Richards: During the course of the flight we managed to have about a dozen school interviews with various schools from Australia, Africa, South America and, of course, the United States. We also had the capability on board to uplink [slow-scan] pictures to the orbiter, and similarly downlink pictures. [In Photo C] you can see school children from Addison Elementary School, along with their teacher, who I gave an interview to during the flight. It was kind of nice to have this ability to beam people up and beam people down, and ev-

SAREX Continues

The next SAREX mission will be STS-47, the 50th shuttle flight. The primary payload for this mission will be the Spacelab Japan long module, a combination of U.S. and Japanese microgravity research. Dr. Jay Apt N5QWL will be the ham for this mission, making him the first astronaut to fly with SAREX on multiple shuttle missions.

The commander of the mission will be Hoot Gibson and the pilot will be Curt Brown. Jay's fellow mission specialists will be Mark Lee and Jan Davis. The two payload specialists will be NASA mission specialist Mae Jemison flying, as a "science mission specialist," and Mamoru Mohri, the first Japanese scientist in space. Jan and Mae will work with Jay on the blue shift. Curt, Mark, and Mamoru will work on the red shift. Commander Hoot Gibson will adjust his schedule as required, but is expected to work the same schedule as the red shift.

SL-J will be a high inclination mission, with many passes over Japan and the Continental U.S. The mission will include the SAREX-C configuration, with packet and voice operations—the same configuration which was flown with Ron Parise WA4SIR's STS-35 ASTRO-1 mission. While *Mir* has had packet for several years, STS-47 will be the first high inclination U.S. ham flight with packet capabilities.

Unfortunately, Jay's shift will be asleep for most of the U.S. passes, but it's likely that the packet gear will be left running. As of STS-47, a new packet frequency has been assigned for SAREX operations—144.70 MHz. Procedures for packet operations will be similar to the ones used for the STS-35 ASTRO-1 flight.

Many of the members of the SAREX team, including several of the ham astronauts, feel that with packet the only requirements for a completed contact should be for the ham to transmit his/her call to the receiver (shuttle orbiter) without requiring an additional hang-up confirmation. The "heard list" will be stored on the crew's onboard microcomputer. NASA recently qualified a space modem and the packet "heard list" will be modemed to the Johnson Space Center amateur radio club using the shuttle's conventional data links. W5RRR is planning to retransmit the "heard list" via packet BBS's during the mission, permitting a rapid feedback if you've successfully contacted the shuttle.

In comparison with recent SAREX flights, this will be a relatively low-key mission. Jay's schedule will preclude many U.S. voice contacts: He's the only ham astronaut on board, and only a handful of school contacts have been planned. But it will permit hams at middle and high latitudes to contact the shuttle via packet for the first time.

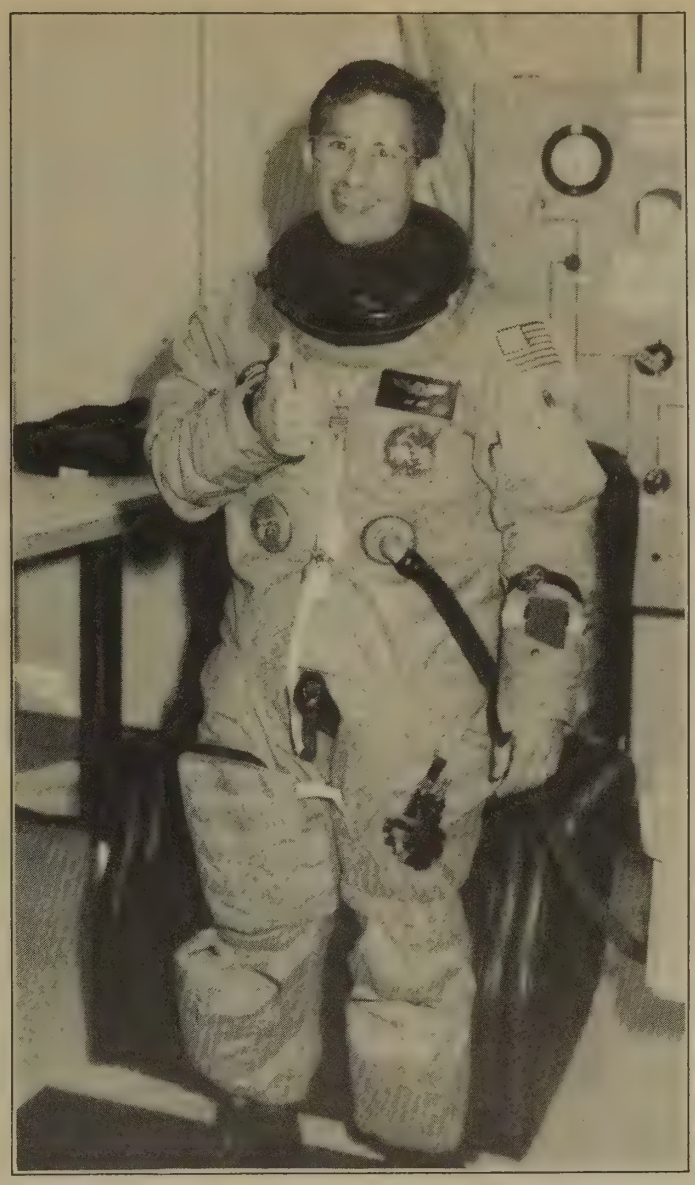

Photo F. Jay Apt N5QWL will fly next on STS-47.

erybody had a good time with it, and it got a lot of people interested in this kind of technology. Ellen and I talked to about a hundred people a day and I think that generated a lot of goodwill for the space program throughout the world.

The fast-scan was a little bit of a disappointment. The good side of it was the special event that Jay Leno did for us. That was about the most successful of the uplinked video we got. We got almost 100% of the video and 50% of the audio. Later on there were a lot of other [ATV hams] both locally here [W5RRR Houston] and elsewhere for video to provide us entertainment that I wish we could have gotten onboard. I think we learned some things from this, and we're going to encourage this particular technology so future crews will have it. For long duration flights, having these types of things uplinked to you are a real source of entertainment for us.

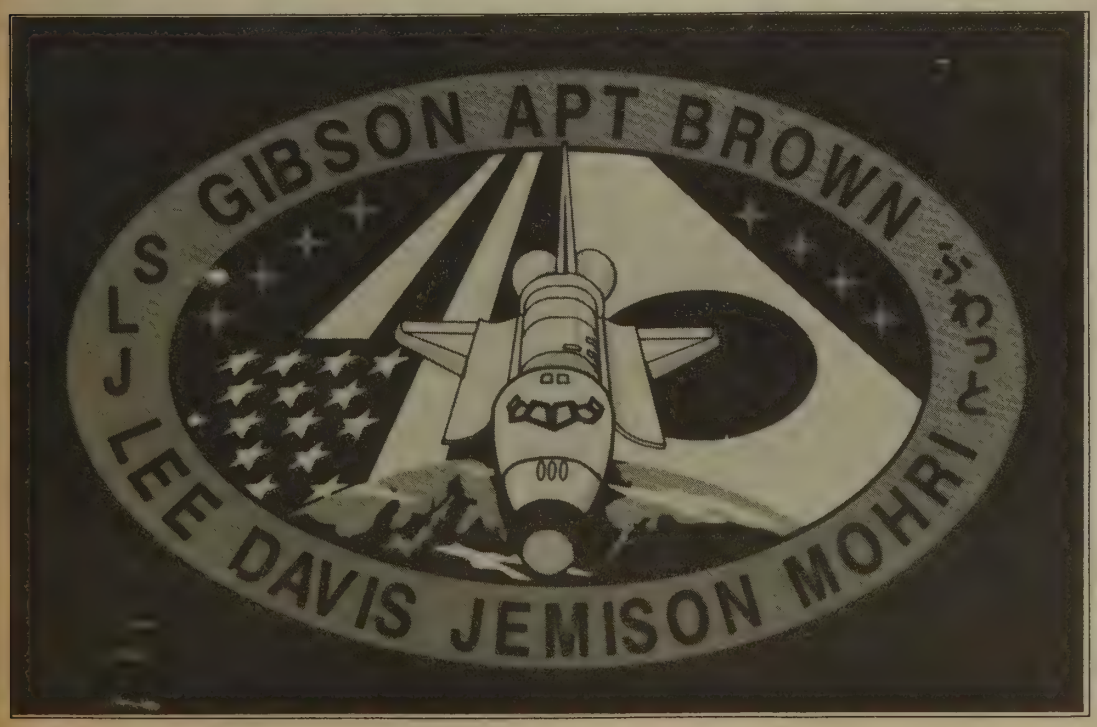

Photo G. STS-47 crew logo.

Ellen Baker: It was a lot of fun for all of us who talked on the radio. Dick and I were the major users of SAREX—we're the ones who got licensed before the flight. So we just talked to anybody who was up on the airwaves. But most of the other members of the crew got to make some personal family contacts as well. It was a real nice thing to have, something that we haven't been able to do very much on previous shuttle flights—to talk to family members or friends on the ground, and that was a nice bonus.

Payload Specialist *Larry DeLucas* isn't a ham but he got a chance to talk to his father and friends at the University of Alabama in Birmingham. He told us: It was really special for me [to use the SAREX hardware]. I think it gave me extra energy to go back and work harder in the lab. But it meant an awful lot to my father; on a long flight it's a really nice thing to have. RF

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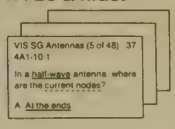

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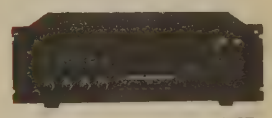

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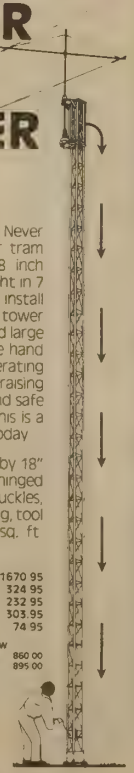

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The Tall Ships

One of the great aspects of amateur radio is the ability to participate in historic events and actually make a difference in the final outcome. The recent Sail Boston '92 was just such an event. During a five-day period over seven million people descended on the Boston waterfront to see more than 200 of the world's largest sailing ships as they paraded through and docked in Boston Harbor.

When that many people cram into a relatively small area, all kinds of medical problems are likely to happen. To respond to this potential for disaster, Supervisor David Ladd of the Boston Emergency Medical Services (EMS), enlisted the aid of the National Disaster Medical Service (NDMS). The NDMS is a coalition of emergency medical jump teams that can be called in from all parts of the country in case of a disaster. The Sail Boston event was the perfect drill for the NDMS support teams. During the attendance peak on Saturday there were 19 separate full-service medical stations scattered around the perimeter of Boston Harbor.

Amateur Radio To The Rescue

Maintaining this many medical stations is quite a logistical nightmare. Proper communications is the key to keeping each station supported. Although medical emergencies were handled with regular emergency frequencies (including C-MED), amateur radio played a large role in coordinating the transportation of personnel, supplies and materials from the base camp (at the Murphy Skating Rink in South Boston) to and from each medical site.

With 19 medical stations (during the peak day on Saturday) requiring support, a large contingent of hams and equipment was needed. Around 150 hams from around New England participated in the five-day event, coordinated through the efforts of the Boston Amateur Radio Club and Event Coordinator Bob Salow WA1IDA. Each medical station had an average of three operators on duty. The typical medical site had at least one 2m FM voice station and most of them had a packet station as well. Each station operated in shifts throughout the event (each station was operational for 12-18 hours a day). The logistics of installing the radio equipment and transporting the operators through the restricted zones of the waterfront was a real challenge, but through the use of remote staging areas, and with transportation help from the EMS group, almost everyone was able to reach their areas, with the exception of one of the harbor islands.

Several companies helped out with equipment for the ham operation. Cellular Security Group loaned 30 of their 2m ground planes and masts for the sites (enough for 2 antennas per location) and IBM supplied 10 XT computers to support the packet installations.

Packet Power

Packet radio really helped gauge the level of medical assistance at each site during the event. The packet operator would key in patient treatment data at each location and send it periodically back to the Joint Agency Command Center. This kind of data really helps the NDMS group to study injuries or other medical problems that may occur as a result of weather or to locate potential hazards at a particular location. This information also allows the command center to plan for the supplies they will need in the future.

A program written by Dave Crocker W1TMO allowed the packet operator to key in the patient on a standardized form and to send out a group of forms directly to the command center for computer analysis and disk storage.

A Success

Since the medical sites were located in a concentrated area in and around central Boston, all amateur voice communications were held on a 2m FM simplex frequency. The packet links were established on another dedicated frequency. The Boston Amateur Radio Club's 2m repeater was also used for overflow emergency traffic and helped the remote sites communicate with each other when necessary.

It was exciting to listen in to the net during the event while watching the incredible sight of hundreds of tall ships descending on Boston. With a happening of this magnitude, there was always activity zipping between the remote stations and net control.

After a day of ham radio and tall ships, it was time to ride back to our cars and exchange stories with fellow participants. It was great to know that we had made one of the largest events in Boston's history go just that more smoothly!

TNX to Event Coordinator Bob Salow WA1IDA for the above information. Additional info provided by Pete Margeson N1IWH. RF

Photo A. Massive crowds lined the shores of Boston Harbor to watch as hundreds of tall ships sailed past.

Photo B. The waters were filled with small boats watching their big brothers (the tall ships) approach.

Photo C. Deb Mullen N1DDW operates from station Foxtrot at the inflatable medical station tent next to Independence Fort at Castle Island.

Photo D. Len Hathaway K1JHR checks in with net control from medical station Foxtrot.

Photo E. Station Echo was located inside Independence Fort at Castle Island. Medical treatment information was relayed via the packet station shown in the foreground. (L to R): Steve Johnson KC1HO and Karl Johnson NS1N.

Photo F. The afternoon shift at station Echo. (L to R): Brad Cole K3XL, "Doc" Carp KT1V and Julian Topolski KR5J.

Photo G. Net control was located at the central supply center (Murphy Rink in South Boston) for all of the remote medical stations. (L to R): Al Carp K1HLZ and Bruce Alexander KA1IG.

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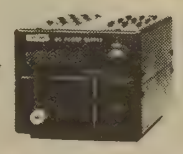

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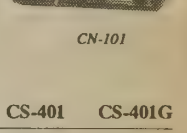

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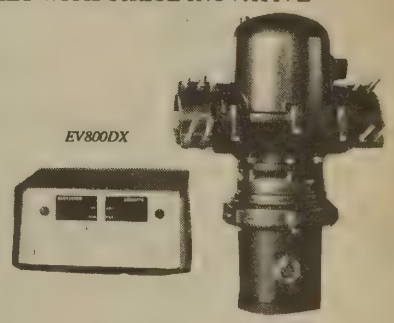

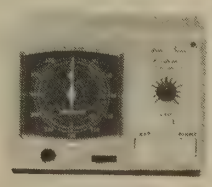

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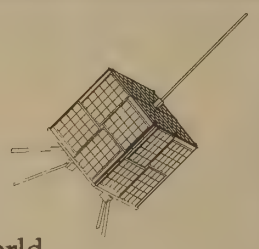

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ANNOUNCEMENTS

GRENADA, MS The Grenada Lake ARC conducts VE Exams the 2nd Sat. of each month at 9 AM, at the Bank of Mississippi, downtown Grenada, in the upstairs Conference Room. Please use rear entrance. Directions: From I-55 and Miss. 8, go east into town to the second red light (US 51 and Miss. 8). Turn left, go to second light, turn right. The bank will be on the left about 3/4 mile. Talk-in on 146.700 (-600) rptr. You will need to bring a photo ID, your original FCC license, and a photocopy of it; your original CSCEs and photocopy, and the $5.40 fee. FCC 610s will be available. Walk-ins welcome. No Pre-registration necessary. Contact: ***Paul Wood N5UHW, (601) 227-2034; Bill Hunt AB5FI, (601) 227-1047***; or ***Bill Barbee AA5ZR, (601) 226-4014***.

SEPT 6

BURLINGTON, IA The Iowa-Illinois ARC Inc. will host Burlington Hamfest '92 from 7:30 AM-3 PM at the Iowa Nat'l Guard Armory, Summer St. Rd. (across from Burlington Municipal Airport). VEC Exams (bring photo ID and photocopy of signed license). Forums. Flights in Amateur Electronic Supply's Starship airplane mobile. Admission $4, children under 12 admitted free with an adult. Tailgaters $3 additional admission per space. Inside vendors, $6 per table plus admission fee. AC power limited. Set-up at 6 AM. Talk-in on 146.79 (146.19 input) WØLAC rptr., and 146.52 simplex. New and used dealers and computer stuff. Contact ***Chuck Gysi N2DUP, Burlington Hamfest '92, P.O. Box 974, Burlington IA 52601-0974***, or call ***(319) 752-3000***.

SEPT 12

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Assn., Inc., will host Hamfest 92 at the County Fairgrounds in Ballston Spa NY, rain or shine. Directions: Interstate Route 87 to Exit 12; follow orange and white hamfest signs. Set-up Fri. from 7 PM-8:30 PM. Limited camping w/hookup Fri. night, $15 plus tax. Admission $4 per person (includes 1 tailgate spot). Inside tables $5 ea, first come, first served (we encourage pre-payment). New and used equipment. Talk-in on WA2UMX rptrs., 146.40/147.00 and 147.84/24. Contact ***N2FEP, P.O. Box 41, Rock City Falls NY 12863***.

DALTON, GA The Dalton ARC will hold the Dalton Trade/Swap Day at Praters Mill on GA Hwy #2, 7 miles north of Dalton. Bring your own tables, chairs, tailgates, etc. Free admission. Members of DARC will be on site Fri. eve. for early arrivals (RVs, campers, etc.). Come as early as you wish and stay as late as you wish. No reservations. Talk-in on 145.230-, 443.000+ PL 203.5. For info call ***KB4MJW @ (706) 226-2583*** anytime.

DUCK HILL, MS N5UHW and Grenada Lake ARC will sponsor the 10th Annual Bogue Creek Festival at Duck Hill Community House, next door to the Post Office in Duck Hill MS, from 8 AM-12 PM local CDT. Bring your own swap tables. Walk-in VE Exams at 1 PM; bring original and copy of FCC license, original and copy of any CSCEs, a photo ID and $5.40. Talk-in on 146.700 (-600). SE Station N5UHW will be in operation. Contact ***Paul E. Wood N5UHW, P.O. Box 292, Duck Hill MS 38925-0292. Tel. (601) 565-7286***.

ELMHURST, IL The 40th annual Convention of W9DXCC will be sponsored by the Northern Illinois DX Assn. (NIDXA). W9DXCC membership includes every holder of DXCC in the 9th call area—about 7,800 active DXers. The program will include talks on recent DXpeditions, new and effective equipment and techniques, DX packet cluster, station aids, etc. For info, contact ***NIDXA, P.O. Box 519, Elmhurst IL 60126***.

ERIE, PA The Radio Assn. of Erie will host Erie Hamfest '92 at Rainbow Gardens, adjacent to Presque Isle State Park, from 8 AM-2 PM. ARRL sanctioned. There will be VE Exams at 8 AM at Room 107, Villa Maria Campus, 2551 W. 8th St. Admission $4. 12' tables $8. No tailgating. Talk-in on 146.01/61. For info, contact ***Tom McClain N3HPR, 3954 Solar Dr., Erie PA 16506. Tel. (814) 833-1640***.

LAPORTE, IN The LaPorte ARC Fall Hamfest will be held at LaPorte County Fairgrounds, State Rd. 2 West. Admission $4. Tailgating free. Tables $5 each. Talk-in on 146.520. For tables and info contact ***Tom Lewis KA9ZUM, c/o LPARC, P.O. Box 30, LaPorte IN 46350. Tel. (219) 362-6848***.

UNIONTOWN, PA The Uniontown ARC will hold their 43rd Annual Gabfest on the Club grounds on Old Pittsburgh Rd., just off route 51 and the 119 by-pass. Talk-in on 147.045/.645 and 145.17/144.57. Contact ***U.A.R.C., c/o John Cermak WB3DOD, P.O. Box 433, Republic PA 15474. Tel. (412) 246-2870***.

SEPT 13

FINDLAY, OH The Findlay Radio Club, Inc. will hold its 50th annual Hamfest at the Hancock County Fairgrounds, East Sandusky at Fishlock, in Findlay OH. Advance tickets $4 ea., $5 at the gate. Reserved tables $12 for the first (includes admission for 1) and $8 for each additional table. Make check payable to ***Findlay Radio Club, Inc.*** and send with SASE to ***FRC Tables, Box 587, Findlay OH 45839***.

JOLIET, IL The Bolingbrook ARS will host Hamfest '92 and Computer Fair at the Inwood Rec. Center, 3000

W. Jefferson St., Joliet IL, starting at 6 AM. Gymnasium opens 8 AM Sun. Dealer set-up Sat. 6PM-8 PM; Sun. 5 AM. Overnight parking, no hookups. Advance tickets $4, $5 at the gate. Reserved dealer tables indoors, $10. Reserved Flea Market tables indoors, $6. Any remaining indoor space will be available on a first-come first-served basis. VE Exams, walk-ins welcome. Bring original license and photocopy, ID and photo ID, plus test fee. Novice tests free. Talk-in on 147.33 +0.6, 224.54 -1.6, 146.82 -0.6 MHz. For info call *(708) 759-7005*. To reserve tickets, mail your check and SAE to ***Bolingbrook Amateur Radio Society, P.O. Box 1009, Bolingbrook IL 60440***. To reserve tables, write to ***BARS, P.O. Box 1009, Bolingbrook IL 60440. Tel. (708) 759-7005***.

SOUTH DARTMOUTH, MA The South Eastern Mass ARA will hold its 5th annual Hamfest/Flea Market from 8 AM-3 PM at the Club grounds, 54 Donald St., South Dartmouth MA. Admission $2. Tables $8 in advance, $10 at the door. Talk-in on 147.00/.60 and 145.49/144.89. Contact ***Michael Enos, P.O. Box 79604, North Dartmouth MA 02747***.

SEPT 19

BERLIN, VT The Central Vermont ARC will hold the 4th annual Fall Foliage Hamfest/Fleamarket inside the Nat'l Guard Armory in Berlin VT. Directions: Exit 7 I-89, turn left at third set of lights. Admission $2. Tailgating $4. Inside tables $6 in advance, $8 at the door. For table reservations and info, contact ***Tom Girardi WA1YNU, P.O. Box 53, Plainfield VT 05667. Tel. (802) 426-3789***. ARRL VE Exams at 1 PM. Talk-in on 146.625 W1BD rptr.

CALGARY, ALBERTA, CANADA The 7th annual Calgary Ham Radio Flea Market, sponsored by the Novatel ARC, will be held from 0900Z-1200Z at the Parkhill Community Centre, 4013 Stanley Rd. SW, Calgary, Alberta. Admission $3. Tables $3. Talk-in on VE6NRC 146.76 and 146.52 simplex. To reserve a table, send your name, callsign and $3.00 for each table you would like, to ***Novatel Amateur Radio Club, 208 Canterbury Pl. SW, Calgary, Alberta, Canada T2W 1P4***.

FRANKLIN, PA The Fort Venango Mike & Key Club will hold a Ham Auction-Fest at the Venengo County 4-H Fairgrounds, Route 62 between Polk and Franklin PA. Free parking. Gates open at 8 AM. Auction begins at 10 AM. Admission $2/person, children 12 and under admitted free. Limited indoor flea market spaces $5 ea., bring your own tables. Talk-in on 147.12+, 145.23- and 145.19-. Contact ***Jim Clinefelter N3BAT, (814) 437-1781***; or ***Bruno Wolozyn K3MHB, (814) 677-8694***. Or write to ***Fort Venango Mike & Key Club, RD #1, P.O. Box 591, Cranberry PA 16319***.

SEPT 19-20

MILTON-FREEWATER, OR The 46th annual W7DP Hamfest, sponsored by the Walla Walla Valley ARC, will be held from 8 AM-5 PM at the Community Bldg. in Milton-Freewater. Registration/Admission is FREE. Swap tables (radio gear only, please) are $5. XYL activities. Potluck. ARRL Section Meeting. For VE Exams on Sun. afternoon, bring photo ID, a copy of your license, and $5.40. Talk-in on the 147.28/.88 rptr. Contact ***Carl Elsner N7PVW, 223 W. Chestnut, Walla Walla WA 99362. Tel. (509) 522-1270***.

PEORIA, IL The Peoria Area ARC will sponsor SUPERFEST 92, its 33rd annual Hamfest, at Exposition Gardens, Northmoor and University. Free parking, wheelchair accessible. Overnight camping. Flea Market opens at 6 AM. Commercial bldgs. open at 8 AM. Admission is $5 for the weekend. Forums. Manufacturer Reps. Ladies activities on Sat. VE Exams Sun. For info. contact ***PAARC, P.O. Box 3508, Peoria IL 61612-3508***, or call the Club answering machine at ***(309) 685-6698***.

VIRGINIA BEACH, VA Tidewater Radio Conventions, Inc. will hold the 17th annual Virginia Beach Hamfest/Computer Fair in the Virginia Beach Pavilion and Convention Center Sat. from 9 AM-5 PM; Sun. 9 AM-4 PM. Free parking at the doors. Admission $5 in advance, $6 at the door (good for both days). The Radisson Hotel is next door to the Pavillion, and the Atlantic Ocean is within walking distance. Gordon West WB6NOA will be the featured speaker. Exhibitors and dealers, contact ***Lewis Steingold W4BLO, (804) 486-3800***. For tickets and info contact ***Manny Steiner K4DOR, 3512 Olympia Ln., Va. Beach VA 23452. Tel. (804) 340-6105***.

SEPT 20

ADRIAN, MI The Adrian ARC will hold its 20th annual Hamfest/Computer Show at the Lenawee County Fair Grounds, North Dean St., Adrian MI, from 8 AM-2 PM. Tickets $3 in advance, $4 at the gate. VE Exams, inside Table Sales, outside Trunk Sales. Talk-in on 145.370. For reservations and info, contact ***Dennis Boydston, 2383 E. Clearview Dr., Adrian MI 49221. Tel. (517) 265-8054 after 4 PM EDT***.

BEACH HAVEN, PA The Columbia-Montour ARC will hold its 2nd annual Hamfest/Computer/Electronic Fleamarket at the Beach Haven Carnival Grounds, north of Berwick PA, on RT 11 near the Susquehanna steam electric plant, beginning at 8 AM. Breakfast at 6 AM. General admission $3, XYL and kids under 16 admitted free. Tailgating $1 per 8' space plus general admission. Talk-in on 147.225 or 146.52. Vendors: for info call ***Dave WC3A, (717) 752-6851***.

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. Free off-street parking. Admission $2. Covered tailgate area. Sellers spaces $5 in advance (includes 1 admission), $8 at the gate. Set-up at 7 AM. For space reservations or info, call ***(617) 253-3776***. Mail advance reservations before the 5th to ***W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139***. Talk-in on 146.52 and 449.725/444.725 - pl 2A W1XM rptr.

MT CLEMONS, MI The 20th annual L'Anse Creuse ARC Swap and Shop will be held from 8 AM-2 PM at L'anse Creuse High School. Directions: From I-94 take exit 236 onto eastbound Metro Pkwy, then to Crocker Blvd; left onto Crocker, then right onto Reimold to the last school. Admission $3 in advance (by Sept 8th), $4 at the door. VE Exams at 11 AM. Contact ***Don WA8IZV, (313) 294-1567***. Tables $10. Trunk sale space $4 per space at the swap. Vendor set-up at 6 AM. For more info send SASE to ***Jerry Luh KA8QBC, (313) 651-7387, 732 Brookwood Ln., Rochester Hills MI 48309***.

PENNSAUKEN, NJ The South Jersey Radio Assn. will sponsor its 44th annual Hamfest/Computer Show at the Pennsauken High School parking lot, rain or shine, from 8 AM-3 PM. Free parking. Tailgating. Swap shop. VEC Exams, all classes; register at 9:30 AM. Advance tickets $4, $5 at the gate. Tailgate, 8' space, $5 (does not include admission). K2AA Talk-in on 145.290 (-600), SJRA rptr. For advance sales, send check and SASE to ***Alan Sherman KE2VX, 222 Park Ave., Atco NJ 08004. Tel. (609) 768-8380 eves. after 7:30 PM***.

SANDY HOOK, CT The Candlewood ARA of Danbury CT will hold its annual Ham Fest at Sandy Hook Fire House, Riverside Rd., from 8 AM-2 PM. Tailgating $6. Inside Tables $8 on first-come first-serve basis. Commercial vendors welcome. Talk-in on 147.12/.72 (PL 141.3) Danbury rptr. Contact ***John N2DVX, (203) 438-6782***, or ***Craig N1ABY, (203) 426-1652***.

SEPT 26

BELTON, TX HAM EXP.O. '92, the largest indoor Tailgate Swapfest in Texas, will be held at the Bell County Expo Center. Take I-35 (exit 292). Wheelchair accessible. Free admission. VE Exams. There will be a fully equipped test bench for equipment checks. Set-up at 6 AM. Open to the public 8 AM-3 PM. Seller pre-registration $8 by Sept. 19th, $10 after. Your choice of 8' table or indoor tailgate space. Additional tables $4, $5 at the door. Electricity $2. Registration/checks to ***Temple ARC, 2014 S. 53rd, Temple TX 76504***. Contact ***Mike WA5EQQ, (817) 773-4768***.

ELMIRA, NY The Elmira ARA will present the 17th annual International Hamfest at the Chemung County Fairgrounds. Outdoor Flea Market. Indoor Dealer Displays. Gate will be open from 6 AM-5 PM. Tickets available at the gate, or in advance from ***Dave Lewis, RD1, Box 191, Van Etten NY 14889***.

SANTA FE, NM The Northern New Mexico ARC will host the 1992 Northern New Mexico Hamfest at Glorieta Baptist Conference Center, 16 miles southeast of Santa Fe on I-25, exit 299. Flea Market. Free Tailgating for registrants. Overnight camping with hookups at $9.30 per night. Camping without reservations is on a first-come first-served basis. Contact the ***Glorieta Baptist Conference Center, P.O. Box 8, Glorieta NM 87535***, with remittance, to secure your spot for Fri. and/or Sat. night. Hotel/motel rooms are available—call ***(505) 757-6161*** for info. Admission is $5 at the gate. Talk-in on 146.18/.78 and 146.52/.52. Contact ***Helenrose Burke W5IXS, P.O. Box 73, Ojo Sarco NM 87550. Tel. (505) 689-2367***.

WARSAW, IN The American Red Cross ARC of Warsaw will sponsor its 2nd annual Warsaw Hamfest from 8 AM-2 PM at the Nat'l Guard Armory, 2 miles north of Warsaw. Take Ind. 15 North to Co. Rd. 350 N. Turn East. It's just across the tracks. Tickets $3.50 in advance, $4 at the door. Tables $5. Tailgate sales free with admission. W5YI VE Testing. Talk-in on 146.985 or 442.55 rptrs. For info call ***John Sparks KA9QWV, (219) 269-5187; Harold Dunn KA9TUQ, (219) 269-9652; Paul Van Dyke KB9AVO, (219) 457-5432***. Dealers write to ***ARC2 Hamfest 92, 1516 Maye St., Warsaw IN 46580. Tel. (219) 269-5187***.

SEPT 26-27

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL Great Lakes Div. Convention will be held at the Commonwealth Convention Center in downtown Louisville. Advance tickets $6 with SASE; $8 at the door. Commercial and flea market spaces available. For tickets or info, mail to ***P.O. Box 34444-S, Louisville KY 40232-4444. Tel. (502) 551-4118***.

WICHITA, KS The Wichita ARC will host the 1992 Kansas State ARRL Convention at the Ramada Hotel at Broadview Place, 400 West Douglas, Wichita KS 67202. For more info contact the ***Wichita Amateur Radio Club***.

SEPT 27

LONDON, ONTARIO, CANADA The London ARC will hold its 15th annual Hamfest at the Pot O'Gold Bingo Palace, Hamilton and Gore Rds, London Ontario from 9 AM-2 PM. $5 Admission includes door prize ticket. Vendor set-up 8 AM. Tables $5. Talk-in VE3LON 147.060+. Send reservation payments to ***London Amateur Radio Club Inc., P.O. Box 82 STN B, London, Ontario Canada N6A 4V3***. For info call ***Jim Hartford VE3NRX, (519) 672-7911***.

LONGMONT, CO The Boulder ARC will host its Amateur Radio Electronics and Computer Swap Meet at the Boulder County Fairgrounds Exhibition Bldg., Nelson and Hover Rds., Longmont CO.

Free parking. Camp sites and shopping nearby. VE Exams. Set-up at 7 AM. Doors open at 8 AM. Admission $3. Tables $7 (chairs available). Call ***(303) 530-2903*** to obtain table reservation forms or make VE testing reservations. Mail table reservations and inquiries to ***BARCFEST, 1103 South Gay Dr., Longmont CO 80501***. Reservation deadline is Sep. 19th. Walk-ins welcome, first-come, first-served.

MILFORD, CT The Coastline Amateur ARA will sponsor VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., Milford CT, starting at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125***, or ***Dick WA1YQE, (203) 874-1014*** for more info.

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CIRCLE 68 ON READER SERVICE CARD

NEW PORT RICHEY, FL The Suncoast ARC will hold the 2nd Pasco County, Florida Hamfest at the New Port Richey Recreation Center from 9 AM-5 PM. Directions: US Hwy. 19 to Main St. in NPR; go east 1.5 miles to Van Buren. Turn left (north) 1 mile on right side. W5YI Exams. Admission $5 at the door, children under 12 admitted free. YL and XYLs free. Sellers $15 (pre-registration required). Tables $15, includes chair and one admission. Electricity is $5 extra. Talk-in on 145.35 local, and 147.150 distance. Contact ***Suncoast Amateur Radio Club, P.O. Box 7373, Hudson FL 34676*** or call: ***Ralph N4QIK, (813) 847-4043***, or ***Mitch KM4MU, (813) 848-5526***.

YONKERS, NY The Metro 70cm Network will sponsor a Giant Electronic Fleamarket at the Lincoln High School, Kneeland Ave., off Yonkers Ave., from 9 AM-3 PM. Set-up at 7 AM. Ham Gear. Computers. VE Exams. Free parking. Free frequency checks. Admission $4 each. Kids under 12 free. First table $15; $10 each additional. $1.80 per foot (your table min. $10.). Full payment in advance. Contact ***Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. Tel. (914) 969-1053***.

OCT 3

CHERRY HILL, NJ The Pack Rats (Mt. Airy VHF Radio Club, Inc.) will sponsor the 16th annual Mid-Atlantic States Conference and Banquet on Sat. Oct. 3rd. For more info send #10 SASE to ***VHF Conference, P.O. Box 311, Southampton PA 18966***.

ROCK HILL, SC The York County ARS will hold its 41st annual Rock Hill Hamfest at the Charlotte Knights Baseball Stadium just south of Charlotte NC on I-77, from 7 AM-5 PM. Advance tickets $5, $6 at the door. One parking space included. Wheelchair accessible. Covered display space. VE Exams. Flea Market. Camping nearby. Talk-in 147.030 (-600). For info and advance tickets contact ***Tom Lempicke AB4YV, 2129 Squire Rd., Rock Hill SC 29730. Tel. (803) 328-3837***. Please SASE.

OCT 3-4

BILOXI, MS The Mississippi Coast ARA, Inc. will hold its 16th annual Ham/Swapfest at the Mississippi Coast Coliseum and Convention Center. VE Exams Sat. at 1 PM, Sun. at 11 AM. Admission $2. Weekend table rental $15 by pre-registration only. Free parking. Handicap parking. RV hookups and dump station $10 per night. No tailgate spaces or outside tables available. No commercial dealers or equipment sales in swap area. Contact ***Ernie Orman W5OXA, 15625 Little Joe Rd., Biloxi MS 39532. Tel. (601) 392-2816***.

OCT 4

CHERRY HILL, NJ Hamarama '92, sponsored by the Mt. Airy VHF Radio Club, Inc., will be held rain or shine at Garden State Park, Rt. 70 and Cornell Ave. from 7 AM-4 PM. Buyers $4 admission plus $1 parking. Sellers add $8 each 10 x 20 parking space (bring your own tables). For info send #10 SASE to ***Hamarama '92, P.O. Box 311, Southampton PA 18966***.

SPRINGFIELD, OH The Springfield Independent Radio Assn. (SIRA) will sponsor the Springfield Hamfest/Computer Expo at Clark County Fairgrounds on State Route 41, just north of I-70, from 8 AM-3 PM. Advance tickets $4, $5 at the door. Advance tables $8, $10 at the door, if available. Talk-in on 145.45/R(-), 224.26/R(-). For more info, write ***SIRA, P.O. Box 523, Springfield OH 45501***, or call ***Hamfest Chairman Ralph Pamer WA8KSS, (513) 325-1456***.

OCT 11

LIMA, OH The Northwest Ohio ARC of Lima OH will host a Hamfest at the Allen County Fairgrounds, Rt. 309E off I-75 Exit 125A-B. Advance Tickets $4, $5 at the door. On-site camper parking, $7 for electric hook-up. Security guards all night. Gate opens at 6 AM. All areas are wheelchair accessible. Set-up Oct. 10th, 3 PM-11 PM; Oct. 11th, 5 AM. Tables $8. Send check or money order with SASE at least two weeks in advance to ***WD8BND, P.O. Box 211, Lima OH 45802***. To pre-register for VE Exams, send completed 610 form, copy of license, check for $5.40 made out to ***ARRL VEC***. Send to ***W8TY, P.O. Box 211, Lima OH 45802***. On a separate sheet of paper, please state which elements of exams you wish to take. Cutoff for Exams registration is Oct. 3rd. Talk-in on 146.67, 145.17, 444.925 Std. Splits.

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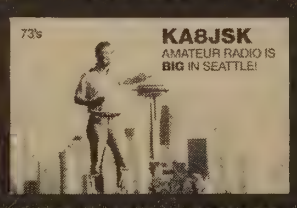

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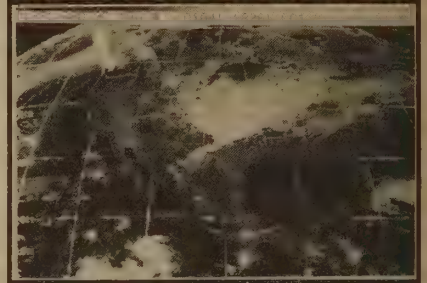

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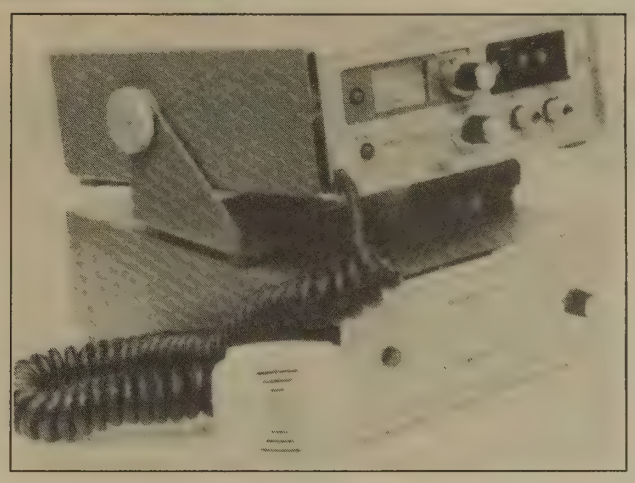
CIRCLE 132 ON READER SERVICE CARD

RF vintage review

Heathkit HW-2036 Synthesized 2 Meter Transceiver

by Stan Miastkowski WA1UMV



Do you do a slow burn every time your old buddy comes on the air and brags about his brand-new synthesized rig? Does he rub in the fact that what he paid for it roughly equals a month's pay for you? Do you get the old here-we-go-again feeling every time a new repeater comes on in your area and you spring for a new set of rocks? Well, there's a solution. By careful searching at flea markets and hamfests you can usually find a fully synthesized 2 meter rig with specs and features equaling radios that cost many times more.

I'm talking about the Heathkit 2036. This rig has the solid look and feel that hams have come to expect from Heath amateur equipment. The unit weighs 6-1/2 pounds and features the usual turquoise blue finish. The folks at Heath have provided the multi-packaging of their kits with a large number of parts. Six sub-packs keep all those little parts well separated until they are needed. The manual hefts out at 160 pages and is in keeping with the Heath tradition of step-by-step crystal-clear directions. A separate fold-out section contains all the pictorials so they can be conveniently mounted over the work area for easy perusal.

The HW-2036 is definitely not a quickly-assembled one-evening kit. *[Ed. Note: It's unlikely that you'll find an unassembled HW-2036 kit, but do try to obtain the manual with the rig.]* There's a large number of parts and quite a few steps to the assembly. Five circuit boards are involved. They're interconnected with a pre-assembled wiring harness. Access to the boards for the big step of alignment is excellent. There are eight sections involved, for a total of nearly 100 alignment steps. For this, you need a VTVM or high-impedance VOM, as well as a receiver that tunes WWV. Even better, use a frequency counter that reaches 150 MHz. Although the steps are quite time-consuming, alignment isn't a terribly complicated procedure. Any 2 MHz segment of the 2 meter band can be selected.

On a weekend trip, I worked a number of repeaters in the New England area. Just about everyone I talked with commented on the clean and crisp audio output. Remarks like, "It must be a Heath!" were common. The rig features a 10-watt output, which was adequate for all but the fringe areas. I'm a bit spoiled anyway since my old rig ran 45 watts. My impression is that one can get along just fine without an external amplifier, considering the proliferation of repeaters.

The economy-size illuminated meter is a joy to use. It shows both received signal strength and relative RF output. A bright green LED situated next to the meter pops on to show there is a signal being received.

A red LED labeled "Synth Lock" lets you know when the synthesizer is not locked to frequency. If you don't notice it and the unlocked condition lasts for more than one-half second the transmitter is automatically disabled by a safety circuit to insure that you won't accidentally operate outside the band. Another fail-safe built into the HW-2036 disables the transmitter if you dial above 147.995 or below 144.00. If you're into MARS or CAP, don't despair, since this can be defeated by the simple act of removing a jumper on one of the circuit boards.

I found it helpful to put a small hooded light over the channel selector switches so I could more easily set them at night.

Heath told me that they had been having a few complaints about audio with the HW-202. Checking into them, they found that some customers had put non-standard mikes on the units. To eliminate this problem on the HW-2036, they made the mike non-detachable.

I've always wondered why Heath mikes are white. On a dark New Hampshire night, I found out. Having no mike clip on the dashboard, I have to lay the mike on the dark-colored upholstery. This requires a good deal of groping. With the shiny white mike, my problem was solved. The HW-2036 comes with either the standard mike or with Heath's Micoder, featuring a built-in Touch-Tone pad.

Adding to the list of built-in features is a subaudible tone encoder. Three switchable tones can be set during alignment in the 70-200 Hz range.

While at the hamfest, look for another logical accessory for the HW-2036: the HWA-2036-3 power supply. It supplies 13.8 VDC at up to 2.7 amps. It features 1% regulation and 0.1% ripple.

For those who are interested in specs, here are a few for the HW-2036. The receiver sensitivity is 0.5 µV for 12 dB SINAD, which comes out to 15 dB of quieting. Audio output is typically 2 watts. IF rejection is greater than -80 dB.

The transmitter is capable of taking a 100% duty cycle into an infinite VSWR. Offset crystals are supplied for plus and minus 600 kHz, with provision for one extra. Current consumption is 700 mA on receive and 2.6 amps on transmit.

The HW-2036 is a pleasure to build and to use. If you want to stop collecting rocks and the piggy bank isn't full enough for one of the big ones, this is sure to be the rig for you. RF

Reprinted from the January 1977 issue of 73 Amateur Radio.

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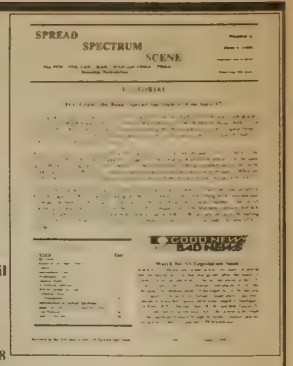

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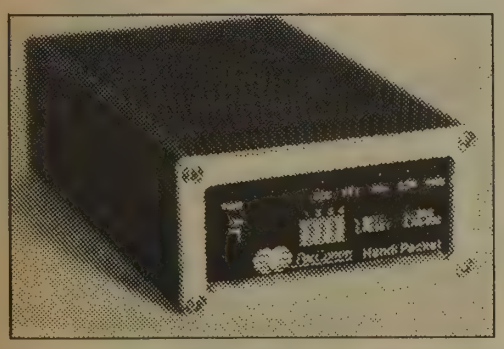

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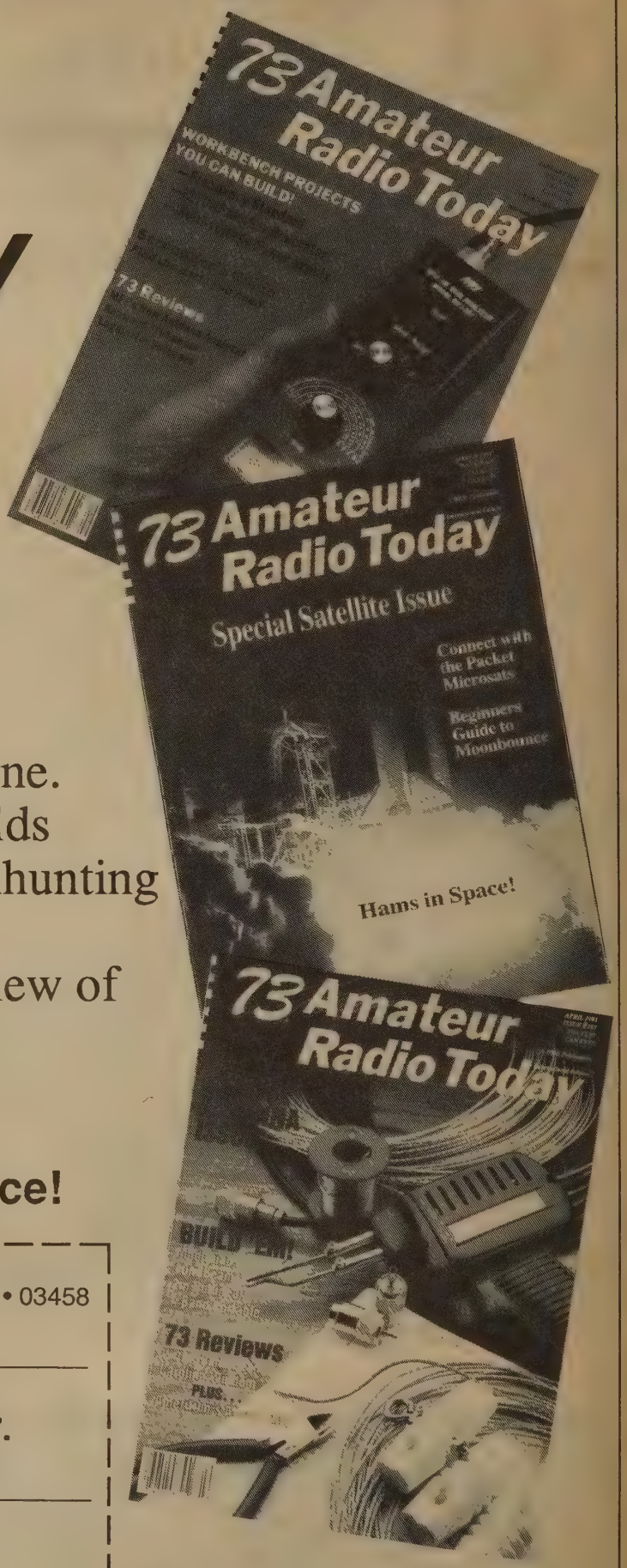

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radio magic

by Michael Bryce WB8VGE

Getting Your Signal Out

I can recall my Novice days and trying to get on the air. After several homebrew transmitters, I finally purchased a used Multi Elmac AF-67 "Transciter." Ah yes, a beastly transmitter if ever there was. It covered 160 through 10 meters in CW, AM and even FM. It had a VFO that actually worked, and if need be I could still use my FT-243 crystals. Remember, in those days Novices had to use crystal-controlled transmitters. About three weeks before my ticket came in, the requirement for crystal-controlled transmit was dropped. Now everyone could be on VFO control.

But there was something very wrong. As Novices before me had said, and as Novices after me will say, "I can't get out." The 'ol AF-67 pumped about 60 watts into the dummy load, the SWR on the antenna was excellent, but I still could not get across the county, let alone across the country. I considered California as good DX back then. I still do today, at my QRP power levels, but what was wrong? I had everything I needed for ham radio. I had a good receiver (for me at least), a good transmitter, an antenna and all the stuff needed to connect it all together.

After some serious head scratching, I began to ask around. I was told I needed an antenna tuner, or transmatch. The man at the flea market told me, "You can load up a set of bedsprings with this baby." Well, I plunked down my money and carried the new toy to the car. I was a happy camper for I would be able to "work the world" tonight.

Well, later than night, it rained on this camper. The transmatch did allow me to load up my antenna on any band on any frequency I wanted. I just could not seem to get out. Oh, I did make contacts, but not like the other stations I heard on the bands. I'd get 459 reports to their 599+ reports. Again, remember, most Novices had older gear and very few had the money to plop down for a new set of Drake Twins or perhaps a Yaesu FT100. Nope, just about all the Novices ran old junk, both for the receiver and the transmitter. There were very few transceivers on the Novice bands back then. (My God, am I dating myself here? I'm not THAT old.)

After much work, and many ques-

Continued on page 30

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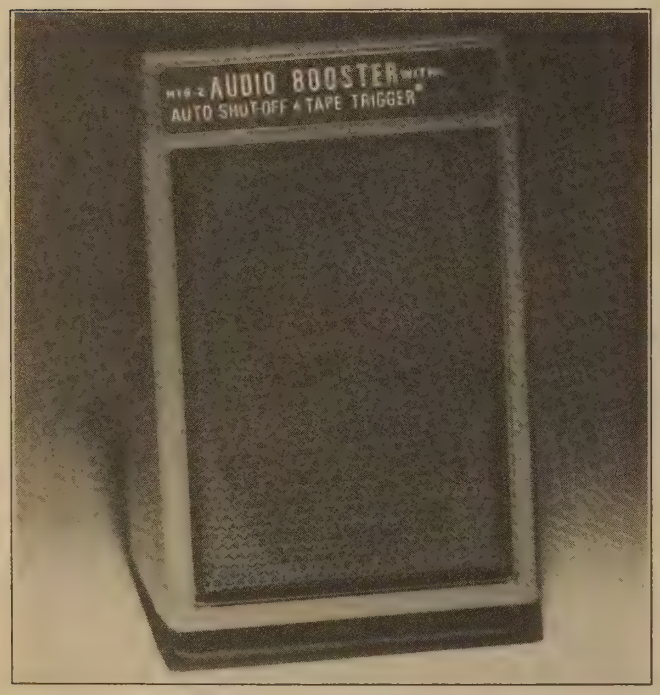

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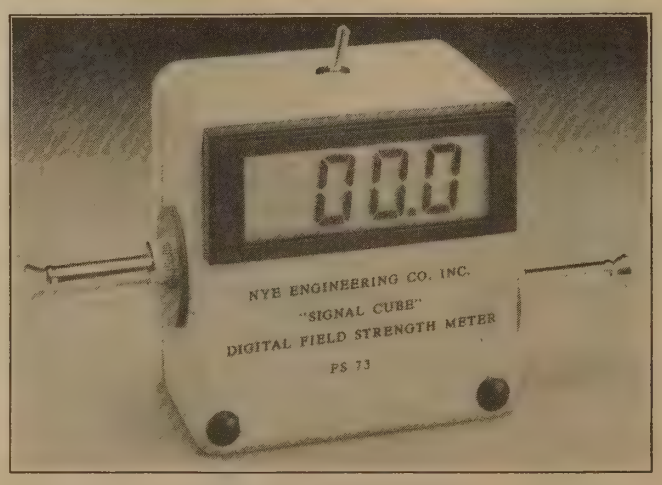

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Nye Engineering has announced a new and unique digital field-strength meter for amateur and commercial use. The FS73 "Signal Cube" is a heavy-duty model, 2.5" square and 2" deep, with a splash-proof cast aluminum case and has a large 3-1/2 digit LCD display indicating RF amplitude. It is broadband (0.1 to 450 MHz) and can be used for absolute or relative readings. A calibration chart on the back of the unit can be used to determine actual volts per meter, up to 150 MHz. The unit uses a standard 9V transistor battery and will operate for two months if the battery switch is left on (a low battery message shows on the display).

The FS73 Signal Cube has many uses, including checking radiation patterns of antennas at relatively great distances, and checking RF levels and detecting sources. It is priced at $159. For more information, contact *Nye Engineering Co., Inc., 4020 Galt Ocean Dr. #606, Fort Lauderdale FL 33308; (305) 566-8560, Fax: (305) 537-4711.* Or circle Reader Service No. 201.

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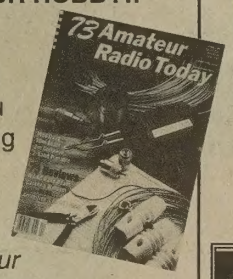

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RF0992

Continued from page 27

tions, I determined that my antenna was the problem. Yes, the antenna tuner did allow me to have a very low SWR, but that alone does not make for a good antenna. It makes no difference if you're running milliwatts or kilowatts, a lousy antenna will give lousy results. It's as simple as that.

Here's what I did wrong. My antenna consisted of a dipole cut for 80 meters. I fed the dipole with RG/8U coaxial cable. With my antenna tuner, I could tune out any reactance and thus make the antenna resonate on any band. This turned out to be my biggest mistake.

Remember the guy who sold me the tuner? He said I could "load up a bedspring" with it. Well, he sure didn't lie. Sure, I could load up a bedspring, but the bedspring would not radiate the power. That's why I could not get out.

Standing Wave Ratio

Okay, so why bother with the antenna tuner? Oh, they have their place, but not for what I was doing. This brings us to SWR or Standing Wave Ratio. I don't really have the space to go into great detail about SWR here. Reams of paper have been consumed explaining it.

When RF is applied to an antenna, sometimes (this depends on many factors) some of the RF power is reflected back to the transmitter. This reflected energy causes voltage standing waves on the transmission line. When this happens, the RF voltage and current are not uniform along the transmission line. By measuring the ratio of the maximum voltage on the line to the minimum voltage, you get the SWR or Standing Wave Ratio. In some cases, you'll see the same term as VSWR, for Voltage Standing Wave Ratio.

Look at SWR like this: If your antenna is at 50 ohm impedance, and you feed the antenna with 50 ohm cable from a transmitter with a 50 ohm output, you'll end up with an SWR of 1:1—a perfect match. Ah yes, but in real life perfect conditions like these are very rare indeed! But let's say your antenna is 100 ohms instead. Using the same 50 ohm cable, we have 100/50 or an SWR of 2:1.

Likewise, an antenna with an impedance of only 25 ohms will also exhibit an SWR of 2:1. This ratio is usually expressed as 1 to 1 (1:1) for a perfect match to 2:1 for a ho-hum match. An SWR of 3:1 is considered rather high, but a workable antenna system. In the modern solid-state transceivers used today, an SWR of over 2.5:1 will cause the transistor PA (power amplifiers) to begin folding back in power to protect themselves. Special circuits monitor the SWR and begin to reduce the RF output. Extremely high SWR may damage transistor PAs.

The lower the SWR ratio, the better the antenna system, but, and let me make this a big but, you can have a 1:1 SWR and still not have a good antenna. A 50-ohm dummy load at the top of the tower will display an SWR of 1:1, and you won't be able to get across town. Many hams get unnecessarily concerned about SWR and spend hours pruning their antennas for that perfect match.

Like most hams, I have an SWR meter in the shack. This little gizmo samples a small amount of RF in the forward position and then allows you to reverse the meter for a reflected power reading. There are quite a few different versions of SWR meters on the market. Almost all wattmeters have SWR functions built-in. If you want to, you may use two wattmeters connected back to back. One will read forward power and the other will read reflected power. To determine the SWR in this fashion, you'll need a monogram chart. This chart is usually supplied with the wattmeter.

Back at the ranch, by using the antenna tuner, I was able to get the SWR down on the transmission line, but I did nothing to increase the antenna's efficiency. My AF-67 "looked into" a 50-ohm load. The antenna's impedance was anyone's guess. An antenna tuner will not "fix" a poor antenna. Even though the SWR was 1:1, the antenna was not resonate and that was the reason I "could not get out."

Well, what good is an antenna tuner if you can't tune your antennas? The best reason for using an antenna tuner is to reduce the SWR down to a usable figure while moving from one end of the band to the other. Right now, my triband beam is resonate on 14.175 MHz. If I try to operate CW on the lower end, 14.010 MHz, the SWR goes sky-high. With the antenna tuner, I can reduce the SWR down to a very low reading. This allows for full RF power from the transmitter, makes me feel better, and constantly reminds me I need to go up the tower and fix the beam.

Because of the tuned circuits within an antenna tuner, they may help reduce TVI (television interference) in some cases. In the older radios with tube finals, those sets have a pi network output circuit, a kind of antenna tuner. You could match many different antennas with the older sets, while reducing TVI. My old AF-67 had a pi output, but it was unable to cope with the impedance of my antenna system.

And that is where we'll pick it up next month—antennas. If ever there is magic to be found in radio, it's the antenna. RF

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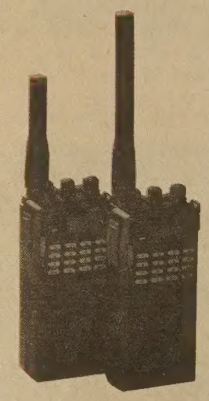
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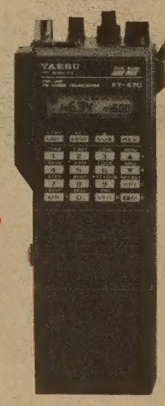
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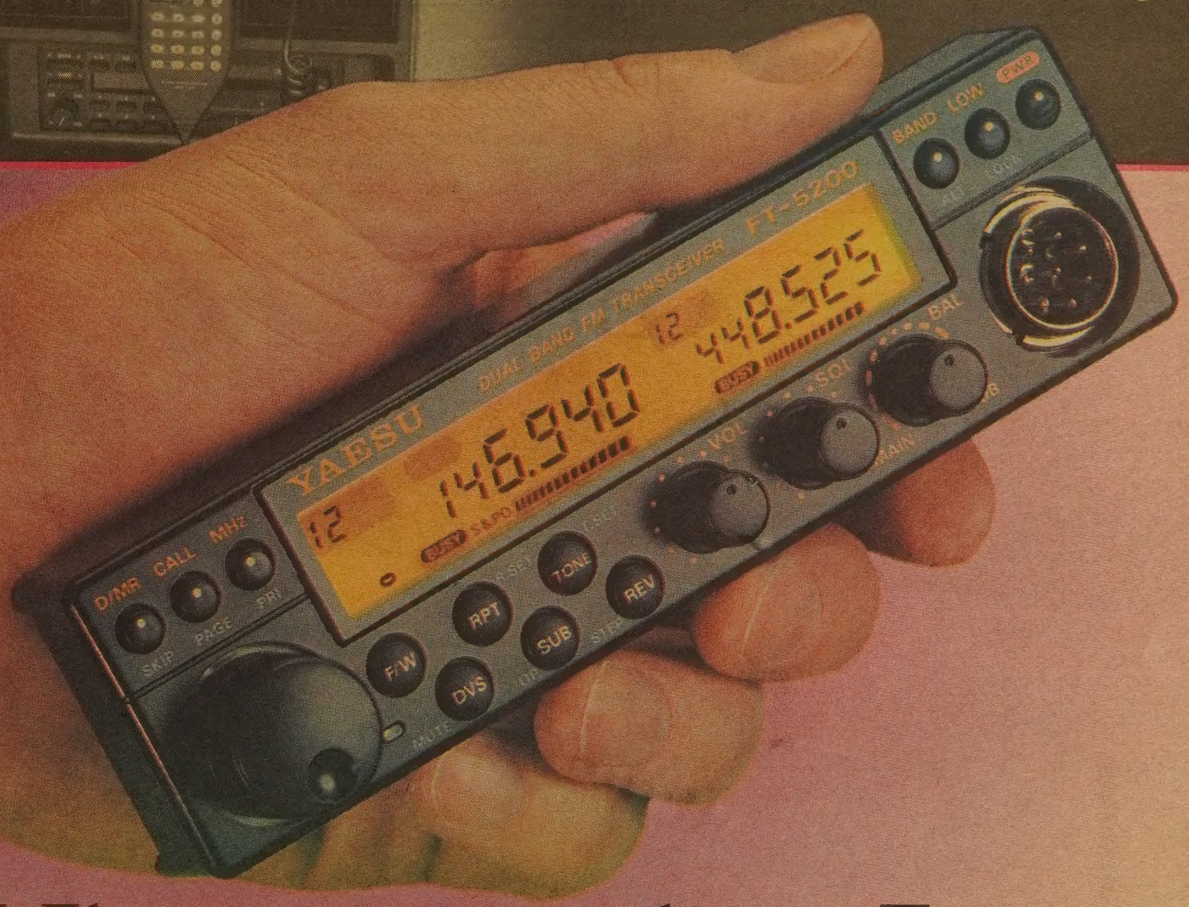

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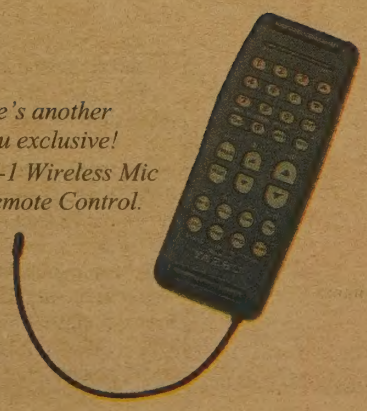

Here's another Yaesu exclusive! The MW-1 Wireless Mic with Remote Control.

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*Performance without compromise.*SM

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Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.

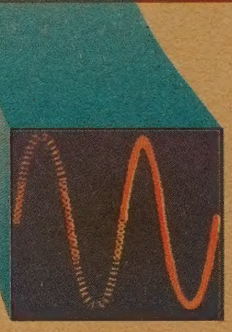
More of what you buy a radio for

More Punch!

Our dynamic **Speech Compressor** increases transmitter output signal strength, to punch through crowded bands and less-than-perfect conditions.

More Clarity!

All other radios in this price class use double conversion circuitry. ICOM uses **Triple Conversion** to improve in-coming signal quality and suppress interference.



More Speed!

Band Stacking Register snaps you back to the last frequency you were on — for contesting, multi-banders. **Direct Digital Synthesis** means fast digital T/R.

More Selectivity!

You won't find **PassBand Tuning** at twice the price! PBT lets you narrow the IF passband width, to zero in on just the signal you want to hear.

IC-728 HF All-Band Transceiver

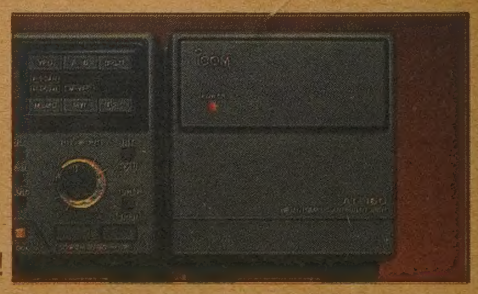
More of what you buy a radio for! The entry-level IC-728 lets you *hear and be heard* better than any other transceiver in its class... because if offers high-performance features previously available only on higher-priced models.

IC-729 HF All-Band Plus!

The NEW IC-729 offers every features of the IC-728, **plus 6-meters, AM/FM, and a tone encoder!** It's like getting the best 6-meter radio for approximately $300! *Attention NoCoders: the IC-729 means you can learn on the best, then expand your world as you upgrade your license!*

Now Available! The AT-160 Antenna Tuner

Fast, compact, simple & smart, the CPU-controlled AT-160 matches your 160M-10M antenna in less than 3 seconds, even when switching bands! Designed as a component, it lets you customize your station. The compact AT-160 mounts directly to the transceiver, forming one integrated unit, automatically controlled from the transceiver.



For more information, call
1-800-999-9877

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All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 728692

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